1378

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Metals; Plating and Coating Metallic Surfaces with Metals, &c.—L. Preaubert, 1150. W. R. Lake (com.), 1216. G. and A. S. Bower, 1280. H. Edmunds, 1348.

Meters for gas and fluids.—J. W. Peyton and J. Salmon, 1333. F. W. Turner, 1363. W. R. Lake (com.), 1391. J. E. Holme, 1494. W. E. Gedge (com.), 1509. E. Waldron, 1511.

Mining, Boring and Blasting Rock, Raising from Mines, Getting Coals, Draining, Lighting, and Ventilating Mines.—G. E. Scarborough, 1161. W. Fairley, 1240. A. Dick (com.), 1266. T. E. Hughes and S. W. Jones, 1309. J. S. Randell and S. Griffin, 1316. J. Whitelaw, 1592.

Mixing, Mashing, Stirring, Agitating.—R. Coslett, 1378. W. Morgan-Brown (com.), 1515.

Motive-power Machines, Obtaining Motive-power.—H. S. Barron, 1170. H. G. Frasi, 1172. W. E. Gedge (com.), 1503. J. M. Plessner, 1557.

Mouldings and Architectural Ornaments.—A. C. Engert, 1364.

Musical Instruments, Music.—H. J. Underwood and E. Bosher, 1329. S. Howard, 1600. H. Fichu and E. Witte, 1605.

Nails, Spikes, Bolts, Rivets, Screws, Nail Extractors, Screwdrivers.—B. P. Walker, 1141. B. Ramsden, 1332. J. L. Heward, 1465.

Nets, Netting, Netting Machines.—R. S. Newall, 1427. J. Temple, 1588.

Oiling or Lubricating, &c.—A. Ogden, T. Marsh, and A. Mills, 1152. G. E. Scarborough, 1161. E. J., H. E., and J. T. Whitehouse, 1295. W. Dunham (com.), 1411 N. Ashton, 1506. T. Ware, 1530.

Oils, Fatty Matters, Grease.—C. N. May, 1186. W. Rowlandson and C. S. Brittain, 1255. D. J. Kennelley, 1286. W. R. Lake (com.), 1345. C. S. Brittain, 1460. F. S. Barff, 1517. H. Rouiax, 1597.

Optical Instruments.—J. G. Fisher, 1177. S. W. Rouch, 1448. E. M. T. Tydeman, 1493. F. Young and J. H. Miles, 1500.

Ornamenting.—T. W. Crees, 1126. J. Schoenfeld and R. Guilmet, 1166. J. Cowper, 1175.

Ovens and Kilns.—W. Radford, 1151. M. Benson (com.), 1293.

Oxidation and Incrustation (Preventing and Removing).—W. R. Lake (com.), 1216. G. W. von Nawrocki (com.), 1273. D. J. Kennelley, 1286. G. Sinclair, 1388. A. M. Clark (com.), 1526. H. Conradi (com.), 1560.

Packing of Pistons, &c.—F. Wirth (com.), 1396.

Packing, Packing Cases, Arranging Goods for Sale.—J. B. Gould and W. L. Evans, 1358. W. Hurst, 1455.

Paints, Colours, Varnishes, Glazes and Lacquer; Painting, Colouring, and Varnishing.—C. Leech and T. Neal, 1281. E. Meyer, 1390. F. S. Barff, 1517. H. Rousix, 1597.

Paper, Pasteboard and Papier Mâche; Paper Hangings.—S. Mason, J. Wolstenholme, and S. Spencer, 1402. A. A. Nesbit, 1487. E. Wright, 1516.

Patterns, Designs, Models.—W. Garthwaite, 1458.

Pens, Pencils, &c.—T. L. Alemand, 1367. W. Devitt and J. Parkinson, 1547.

Photography and Photographic Apparatus.—C. Wayte and C. Herzog, 1407. G. E. Alder and J. A. Clark, 1442. S. W. Rouch, 1448. W. Garthwaite, 1458. . M. Guttenberg, 1502.

Pipes, Tubes and Syphons; Joining Pipes.—W. Radford, 1151. R. Watkinson, 1163. A. and T. Sabine, 1179. T. N. Kirkham and S. Chandler, 1219. J. G. Wilson (com.), 1270. G. W. von Nawrocki (com.), 1273. E. Roberts, 1351. E. and G. Enoch, 1360. E. Quadling, 1376. A. Barlow, W. Iden, and H. Mills, 1481. J. Marshall, 1484. H. Conradi (com.), 1528. H. Conradi (com.), 1560. J. E. Rogers, 1582.

Pistons, &c.—G. B. Goodfellow, 1135.

Ploughing, Digging, Clod Crushing, Land Rolling, Harrowing, Agricultural Implements, Tilling and Cultivating Land.—T. Hunter, 1567.

Preserving Miscellaneous Substance.—A. M. Clark (com.), 1526.

Preserving and Preparing Articles of Food.—T. Greenwood and T. E. Redman, 1156. S. Pitt (com.), 1188. G. Hollinshed, 1207. G. F. Black (com.), 1236. F. Kingston, 1525.

Presses; Compressing.—H. Rawlings, 1123. A. S. Hallam (com.), 1139. W. Morgan-Brown (com.), 1187. E. C. Prentice, 1298. W. R. Lake (com.), 1440. C. S. Brittain, 1460.

Printing and Transferring; Type and other Surfaces for Printing, Composing, and Distributing Type.—W. R. Lake (com.), 1282. W. Conisbee and J. W. Morgan, 1420. E. Vauthier, 1570. G. R. Geldard, 1595.

Propelling Machinery, Transmitting Power and Motion, Converting Movements.—W. Mead, 1232. A. Heegaard, 1302. H. R. Lumley, 1356. N. Macbeth, 1432.

Propelling Ships, Propellors, Paddle-wheels, and Screws.—H. J. Haddan (com.), 1244. J. L. Corbett and D. Hosie, 1268. J. Forster, 1372.

Pulleys.—N. Macbeth, 1432. W. Morgan-Brown (com.), 1446.

Pumps, Pumping and Raising Water and other Liquids, Pumps, Pistons, and Packing.—G. B. Goodfellow, 1135. J. Slee, 1174. E. Waldron, 1511. R. Hargreaves and J. Bardsley, 1521.

Purses and Purse Fastenings.—J. Thibandean, 1225. W. Stone (com.), 1291.

Rags and Waste, &c.—J. Thornton, 1134. W. Sharp and F. Smith, 1319.

Railways, Permanent Way, Rail Joints, Chairs and Sleepers, Portable Railways, Atmospheric Railways. Switches, points, Crossings, and Turntables.—C. Hodgson, 1326. J. A. Mays, 1537. W. H. Tooth, 1559.

Railways, Carriages, Coupling, Uncoupling, and Altering Position of Carriages and Engines.—A. M. Clark (com.), 1184. A. Giles and G. Gorst, 1229. J. E. Wallis, 1261. C. Roberts, 1331. E. Casper, 1453. S. Leach, 1454. B. Mead, 1539.

Reaping, Mowing, Making Hay, Gathering in Produce.—B. Samuelson and W. G. Mainwaring, 1263. J. Hornsby, J. Innocent, and G. S. Rutter, 1287. C. Hickman, 1315. G. Williamson, 1320. H. Courteen, 1321. W. R. Lake (com.), 1346. J. Whitaker and R. Powell, 1354. W. M'I. Cranston (com.), 1393. A. M. Clark (com.), 1492. A. McGregor, 1598.

Reflectors; Reflection of Light.—J. G. Fisher, 1177. C. E. Billing, 1355.

Refrigerating, Cooling Liquids, Making Ice.—R. Powell, 1127. T. Greenwood and T. E. Redman, 1156. G. Pickett, 1408.

Registering, Indicating, and marking.—A. Adams and S. Coltman, 1252. J. W. Kenyon, 1278. T. Metcalf, 1412. W. L. Wise (com.), 1488. J. E. Holme, 1494. E. J. J. Comer, 1510. G. R. Geldard, 1595.

Retorts and Crucibles; Melting Pots.—A. F. Wilson and S. Douglas, 1217. M. Benson (com.), 1293. A. Longsdon, 1604.

Road making and paving, Cleaning Streets.—C. M. Lloyd, 1276.

Salt.—J. H. W. Biggs, 1336.

Sea-sickness (Preventing).—J. A. Walker, 1405.

Sewing and Embroidering.—A. Anderson, 1147. F. Simmons, 1210. W. R. Lake (com.), 1215. W. R. Lake (com.), 1397. T. Singleton, 1435. W. R. Lake (com.), 1475. J. Ridings, H. McLeod, and W. S. Mackie, 1571.

Ship and Boatbuilding.—Sir J. Whitworth, 1171. W. R. Lake (com.), 1303. J. Shaw, 1308. H. T. Watson and S. J. Woodhouse, 1398. J. A. Walter, 1405. F. W. Heinke and W. G. Davis, 1418. G. A. P. Stanley, 1462. A. Longsdon (com.), 1514.

Ships' Boats (Lowering, &c.)—J. Nicholson, 1609.

Ships (Raising Sunken or Wrecked).—F. H. F. Engel, 1498.

Shirts, Collars, &c.—J. Thibandean, 1225.

Shuttles.—A. Anderson, 1147. T. Westley, W. J. Monk, and L. Holden, 1176. W. Carr and J. Taylor, 1357, T. Crawshaw, 1375.

Sifting, Sorting, and Separating.—C. Pieper (com.), 1124. A. Dick (com.), 1266. J. Hornsby, J. Bonnall, and H. Shield, 1552. W. E. Gedge (com.), 1578.

Signals, Alarms, Communicating Apparatus, Conveying Sounds.—A. M. Clark (com.), 1133. E. Tyer, 1262. C. Hodgson, 1326. S. Canning, 1344. T. T. Powell, 1375. H. J. Haddan (com.), 1426. H. Conradi (com.), 1528. G. Schofield, 1545.

Smoke (Preventing, Burning, and Condensing.—G. Lowry, 1157. F. W. Ashton, 1508.

Soap.—Elizabeth Marriott, 1350. W. R. Lake (com.), 1486. A. Hampel, 1565.

Sowing Seeds and Distributing Manure.—J. J. Smith, 1457.

Spindles.—A. Ogden, T. Marsh, and A. Mills. 1152. N. Ashton, 1506.

Spinning and Preparing for Spinning.—D. Marsland and J. Wilson, 1125. A. Browne (com.), 1128. J. Thornton, 1134. J. W. Wattles, 1173. G. Freemantle and J. Dugdill, 1271. D. Denby, 1294. A. Holden, 1311. R. Haddon, J. Dyson, and E. Austin, 1335. S. Andrew, 1342. S. and C. Gauntlett, 1343. W. Brydon and J. W. Williamson, 1359. W. Walker, 1382. B. W. Scott, 1383. B. A. Dobson and J. Macqueen, 1401. J. Ickringill, C. Hoyle, and H. Smith, 1403. A. M. Fleming, 1416. A. Holden, 1433. F. H. Ziffer, 1507. G. and E. Ashworth, 1572. J. and J. E. Holden, 1590. T. Coulthard, 1610.

Spittoons.—A. and A. Job, 1323.

Spray Producers.—W. W. Rolston, 1324.

Stables, Cattle Stalls.—T. F. Shillington and J. A. Hanna, 1250. J. A. Walker, 1405. B. Mead, 1539.

Steam and other Boilers, Cleaning and Preventing Incrustation of Boilers, Water Feeding Apparatus for Boilers.—A. Hamerton, 1159. A. V. Newton (com.), 1183. F. Livet, 1242. D. J. Kennelley, 1286. M. Benson (com.), 1293. J. and B. Umpleby, 1296. W. P. Bain and A. L. Hopcraft, 1317. B. Sawdon, 1327. A. Dervaux, 1349. G. Sinclair, 1388. C. Smith, 1425. G. R. y Sequira and J. del y Denninguer, 1452. H. E. Newton (com.), 1549. G. and J. Weir, 1568. J. W. Ballard, 1583.

Steam Engines (Stationary, Locomotive, and Marine.)—J. H. Kitson, 1178. A. Whalley, 1251. J. Howden, 1264. J. W. Kenyon. 1278. E. J., H. E., and J. T. Whitehouse, 1295. F. W. Furner, 1363. G. Waller and F. Colver, 1533. W. E. Gedge (com.), 1596. H. Wadsworth, 1606.

Steering or Guiding Ships, Carriages, Ploughs, &c.—F. D. Bowles, 1185. S. W. Snowden, 1300. W. Clarke, 1558. R. Scott, 1593. H. Wadsworth, 1606.

Stone and Slate, Artificial Stone and Marble, Grindstones and Millstones.—J. S. Randell and S. Griffin, 1316. J. Smith, 1482. R. Guelton and D. G. Sandeman, 1602.

Sulphur.—J. Hollway, 1131.

Surgery, &c.—J. G. Fisher, 1177. A. Ford, 1459. J. G. Ingram, 1474. T. Forster, 1532.

Telegraphs; Telegraph Printing Apparatus.—R. and M. Theiler and J. E. Wright, 1155. H. Wilde, 1228. J. Oppenheimer, 1248. C. Hodgson. 1326. A. Paris, 1370. M. T. Neale, 1419. H. Schallehn, 1519.

Tents, &c.—W. C. Rencher (com.), 1512.

Testing Fluids, Liquids, &c.—J. A. Wanklyn and J. W. Cooper, 1504.

Testing Strength of Materials.—G. Westinghouse, 1543.

Thermometers, Barometers, Pyrometers.—E. Roberts, 1351. E. J. M. Cetti, 1594.

Thrashing Machines.—J. Hornsby, J. Bonnall, and H. Shields, 1552.

Tobacco and Snuff, Cigars, Cigar-holders, Pipe and Cigar-lighters, Smoking-pipes, Tobaccopouches.—E. and W. Barling, 1206. D. Wolf, 1257. W. R. Perry, 1544.

Tools, Tool Holders.—A. Giles and G. Gorst, 1229.

Torpedoes.—W. R. Lake (com.), 1303. F. W. Heinke and W. J. Davis, 1418. R. Scott, 1593.

Toys.—P. D. Touffet, 1478.

Tramways and Tramway Carriages, Tramway Locomotives.—E. G. Brewer (com.), 1164. J. H. Kitson, 1178. A. M. Clark (com.), 1184. F. D. Bowles, 1185. A. E. Walton (com.), 1190. L. Hill, 1208. C. L. Light and H. Merryweather, 1438. W. H. Tooth, 1559.

Umbrellas, Parasols, &c.—T. J. Smith (com.), 1428.

Upholstery, &c.—T. Simms, 1289. P. Tufnail, 1469. W. and T. Pearson, 1495.

Valves, Taps, Stop Cocks, Plugs; Regulating the Flow and Pressure of Fluids. — S. Owen, 1213. S. Cutler, 1243. A. Whalley, 1251. A. Adams and T. Coltmar, 1252. M. Benson (com.), 1293. A. B. Brown, 1305. W. Drummond, 1310. G. Summer, 1322. J. W. Peyton and J. Salmon, 1333. W. Morgan-Brown (com.), 1337. W. Morgan-Brown (com.), 1445. E. Howard and T. Fardon, 1450. W. H. Bailey, 1470. C. Davy, 1501. S. Owen, 1540. W. R. Lake (com.), 1542. H. Green, 1556. E. P. Alexander (com.), 1589. W. E. Gedge (com.), 1596. H. Wadsworth, 1606.

Velocipedes, Bicycles.—J. Harrington, 1137. E. Simpson, 1149. P. Jensen (com.), 1182. J. H. Smith, 1199. E. W. de Rusett, 1330. J. Lang, 1373. J. and T. Law, 1409. E. J. Smith, 1538.

Ventilation; Supplying and Purifying Air for Buildings, Mines, Ships, Carriages, &c.—T. Greenwood and T. Redman, 1156. T. F. Shillingson and J. A. Hanna, 1250. S. Cohen, 1275. R. C. Parsons and E. Palliser, 1353. C. Brothers, 1436. W. Lawrence, 1575.

Washing, Cleansing, and Wringing Fabrics, Yarns, and Materials.—W. A. Smith, 1265. E. Marriott, 1305. W. R. Lake (com.), 1362. T. Bradford, 1479. A. Winward, 1480.

Waterclosets, &c.—S. Johnson, 1585.

Waterwheels and Engines, &c.—A. Whalley, 1251. F. W. Turner, 1363. E. Waldron, 1511.

Weaving, Braiding, Plaiting, Preparing for Weaving.—S. Stevenson, 1132. C. E. Liebrich, 1167. T. Westley, J. Monk, and L. Holden, 1176. W. E. Gedge (com.), 1234. A. Waddington, 1238. H. Portway, 1269. J. G. Tongue (com.), 1284. J. Carr and J. Taylor, 1357. E. A. Hinchcliffe and J. E. Rebbla, 1366. E. O. Taylor, J. Bradbury, and J. Broadbent, 1369. J. Ainsworth, 1389. T. Crawshaw, 1395. H. Conradi (com.), 1425. W. H. Hacking, 1449. E. Robinson and T. Greenwood, 1461. H. Gardner (com.), 1505. D. Sowden and S. Butterfield, 1520. W. F. Bateman, 1562. F. Schofield and J. Turner, 1576.

Weighing Machines, Scales, Indicating Weight. —G. Westinghouse, 1543.

Wheels for Carriages, &c.—E. G. Brewer (com.), 1164. A. Turner, 1209. W. R. Lake (com.), 1362. J. A. Mays, 1537.

Wheels for Machinery.—N. Macbeth, 1432.

Window Blinds, &c.—H. Hughes (com.), 1472.

Windows and Sashes, &c.—J. F. C. Farquhar, 1230. H. C. Gover, 1231. E. Hopkinson, 1239. A. H. Price, 1387. T. W. Halliwell, 1423. C. Brothers, 1436. W. Morgan-Brown (com.), 1446. E. C. Keay, 1451. G. N. Mansfield, 1550.

Wire-Working, Wire Ropes, Telegraph Cables.—G. R. and E. Ashworth, 1253. W. Walton, 1382.

*** *The above List is prepared from the Patent Records by Mr. T. Morgan, Secretary of the Inventors' Patentright Association, Limited.*

A new Potato Digger of simple construction has been patented by Mr. C. O. Seamans, of Chesterton, Ind. It resembles an ordinary plough in appearance, the beam, standard, landside, and share being similar to corresponding parts of a plough, except that the share is made longer, and makes a cut about two feet wide. An arched sifting frame of parallel rods follows the share, which is drawn through the ground at such a depth as to pass beneath the potatoes. The latter are caught by the sifter, separated from the earth, and left behind on the surface ready to be gathered.

Reviews.

HARDWARE.

"Hardware: How to Buy it for Foreign Markets." By J. Wilson Browne. W. Allen, 13, Waterloo-place, S.W.

This work is one of the products of the life of to-day, in which advertisement often assumes such a refined and elaborate character that it becomes difficult to say to what class a particular book should be assigned. In the present case it is no easy matter to say whether this is an expanded trade circular or not; anyhow, those who are likely to have dealings in ironmongery and hardware will find its pages replete with useful information, which is presented in such a form that it is readily available for use. From galvanised iron houses to hooks and eyes, and thimbles, there will be found pictorial representations of the different sorts and sizes of articles, accompanied by detailed letter-press particulars. In fact, the work fairly carries out the object stated in the introductory portions of the book: that the want of a concise work of reference—giving information upon the details of the trade, sufficiently full to guide the buyer, and yet in so condensed a form as to be portable and handy—has been felt by every one who is in the habit of buying hardware. To supply such a want is the main object of the present work. The books of the kind that have hitherto appeared have generally been mere collections of advertisements. This work is not, in any respect, an advertising medium. Not one penny has been received, directly or indirectly, for the mention or recommendation of any article or maker; and if a maker's name appears, it is because he is either (in the judgment of the compiler) the best, or the only producer of the goods described.

The first part of the work consists of tables showing the weights of various sizes of metals and the rates usually paid for what are called extra sizes. For some of these tables the compiler is indebted to a very useful volume entitled "Beecroft's Companion," and published by Mr. Beecroft, of Leeds. Following these tables will be found lists and illustrations of the most important articles of export, together with a few more novel inventions that are likely, from their intrinsic worth, soon to attract attention.

The "Gross" lists are printed in red ink. By those who are in the habit of buying hardware, the difference between gross and nett lists is perfectly understood. For the benefit of persons who are not accustomed to the details of the trade, it may be necessary to give some explanation. Nett lists give pretty nearly the actual wholesale prices of the goods, and are subject to alterations at the will of the makers by whom they are issued. In some cases they are subject to a discount. Gross lists are prices common to a number of makers in the same trade, and are not altered, except by general consent. They are regulated by a discount varying with quality, assortment, the state of the markets, &c. This discount is usually called a "long discount," to distinguish it from that which is allowed for cash payment. Surprise has often been expressed at the use of these gross lists and long discounts. They arise from the number of sizes of an article often required to be shown in one list. To alter the prices of all these sizes, upon every rise or fall in value, would be a work of great labour. It is manifestly a more convenient mode to leave the prices unaltered, and simply to indicate the change by the rate of percentage allowed. Then the high rate of discount upon some articles (as screws, frying pans, &c.) has led some persons to suppose that the object is to leave a large margin for imposing upon the purchaser. This is quite a mistake. When the list was originally framed, the goods named in it were probably made by hand. The introduction and increased use of machinery have gradually reduced the cost until an article that once sold for a shilling can now be had for two or three pence. Hence a gradual increase in the rate of discount, which has been known to go as high as 87½ per cent, or 7s. 8d. of the whole list price. As a rule the "long" discounts range from 10 to 40 per cent.

The nett prices must be taken as the approximate values, given with a view more especially to show the *comparative* cost of different sizes. To frame a set of prices subject to a fluctuating rate of discount, affecting all alike, would be very difficult, and it would not long be correct. From various causes it will readily be seen that the prices of some goods rise at the same time when those of others fall.

The object thus stated has been well and fairly carried out in this work.

ROUTH'S TREATISE ON MOTION.

"A Treatise on the Stability of a Given State of Motion, particularly Steady Motion." By E. J. Routh, M.A., F.R.S. London: Macmillan and Co.

This treatise is the Adams Prize Essay for 1877, on "The Criterion of Dynamical Stability," with a few additions. The subject for the prize was announced with the following explanation:—"To illustrate the meaning of the question, imagine a particle to slide down a smooth inclined cylinder along the lowest generating line, or to slide down outside along the highest generating line. In the former case a slight derangement of the motion would merely cause the particle to oscillate about the generating line, while in the latter case the particle would depart from the generating line altogether. The motion in the former case would be, in the sense of the question, stable, in the latter unstable. The criterion of the stability of the equilibrium of a system is, that the potential energy should be a minimum; what is desired is, a corresponding condition enabling us to decide when a dynamically possible motion of a system is such that, if slightly deranged, the motion shall continue to be only slightly departed from." This treatise may be considered as fairly dealing with the subject.

HUXLEY'S PHYSIOGRAPHY.

"Physiography: an Introduction to the Study of Nature." By T. H. Huxley, F.R.S. London: Macmillan and Co.

As might be expected, this work is one of the highest merit, and we can only say to everyone desirous of studying the subject to which it has reference, get the book and read it.

POSTPONEMENTS.

"Edison's Talking Phonograph," published by E. J. Davey, Boy-court, Ludgate-hill, E C. From pressure on our space, we are unavoidably compelled to postpone a notice of this pamphlet.

"The Whole-meal Bread Question" (W. Hill and Sons)—which treats of a highly important matter—is also postponed.

Mr. Thomas Fetherstone, of Orange, N. J., has invented a propelling device for boats, in which a screw propeller is acted by a revolving double crank shaft, worked by the feet, which carries a large bevel wheel transmitting motion to the propeller shaft by an intermeshing level pinion at the end of the latter. By means of hand levers, extending forward, additional power may be added by persons in the boat. Mr. Fetherstone makes the propeller shaft fllexibly jointed, to provide for the giving of the shaft to unequal strain, and to admit of adjusting the screw at varying depths under water.

HUGHES' TRIPLEXICON LAMP.

At the members' meeting of the Inventors' Institute, which took place on 28th March ulto., by special arrangement, Mr. W. C. Hughes, optician, read a paper on "Lighting Public and Private Places by Novel Lamp Arrangements," specially applicable to the magic lantern.

Sir Antonio Brady, President of the Institute, occupied the chair, and there was a full attendance of members and friends. In introducing the reader, the Chairman said that he thought the subject would be interesting, especially when they remembered that if they could get cheaper and better magic lanterns (for which the reader's invention was particularly adapted) they would be rendering good service to the cause of education in schools. He (Sir Antonio Brady) had found that in schools magic lanterns were great educators, and enabled the teachers to instruct children, especially in natural history, much better than they could do so without such an aid.

Mr. W. C. Hughes first gave a brief historical account of lighting by lamps. He said that lamps had ever been a great consideration to men in past ages; for in the earliest times of English history various attempts had been made to produce something like a good light. So rude was the construction of lamps some centuries ago that a cane or stick saturated with oil was used for the purpose. That was supplemented by the introduction of common fibres into suitable reservoirs. After other crude attempts the common dip was adopted. Until the intellect of scientific men was brought to bear on the subject, artificial illumination was but an imperfect thing, since which time many improvements had been made. Referring to the argand, moderator, and other lamps, and to the popularity of the arrangement of the duplex wicks as an illuminating medium, he stated that after many successful trials and experiments, he had been enabled to introduce quite a new form of wick arrangement, which was so brilliant that the eyes became dazzled by its unparalleled luminosity, and which for concentration of power was, he contended, unsurpassed. The special feature of the new arrangement was that it was a triple wick, and the lantern which was lighted by the triple wick he called a "triplexicon." The wicks of the triplexicon lamp were somewhat wider from front to back than those in other lamps of similar principle, being almost two inches. That gave burning edges of six inches in length, arranged so as to combine intensity, quality, and quantity. The centre wick was straight, but the two outer ones were slightly curved, and embraced between them the centre one. The wick tubes were well separated, and the flames were all brought into close proximity by a metal cap above the lamp, and through an aperture in which the flames must ascend. A glass cone of sugar-loaf proportions surrounded the flame, which was retained in position by a cone of metal, having two large apertures in the sides opposite each other, one allowing the light to pass backward, where it was received by a reflector, and the other to be projected forward to the conductor, 4 in. in diameter. The metal chimney was attached to the top of the cone. The oil used was paraffin, and a perfect system of ventilation prevented the reservoir from becoming heated. The whole of the hot air was carried directly off through the connective chimney into the room, without congregating, as it in many cases was allowed to do. He spoke of the adaptability of the triplexicon, both for large rooms and public buildings, as well as for ordinary use, and then proceeded to explain its applicability to magic lanterns. For the latter purpose he gave a number of illustrations upon a 10 ft. white screen, by which means pictures and photographs were made to appear perfectly brilliant, and a bright and evenly illuminated disc was obtained, perfectly free from shadow or other blemish. He then exhibited several modern paraffin lamps in comparison with his own invention, which was presented as applied for street and other lamps, evidently of a superior character, and was considered to be more dazzling and brilliant than any of its predecessors. With these satisfactory experiments were made—comparative trials in the magic lantern were given side by side with some of the latest productions of paraffin duplex lights as used in magic lanterns previous to the triplexicon. The test was made on the ten-feet screen. During the trial Mr. Hughes explained the difficulty that often arose of the glass plate or plates that formed either end of the combustion chambers which covered the two flames from their liability to crack under the heat, which would spoil the effect of an exhibition; and this was nicely verified by the fact of one of the glass plates cracking during the trial in one of the above-mentioned duplex lanterns, and which caused considerable delay. He then showed the advantage of his arrangement of the glass chambers and cap that covered the triplexicon wicks, which, although the burning edges of the wicks emitted twice the heat of the others, yet these chambers would resist the heat brought to bear upon them, and allow the hot air to escape more readily into the room, and so keep the lantern body itself cooler. This was thoroughly proved by the fact of his lantern burning for over one and a-half hours during the exhibition of the pictures. Another duplex wick lantern having been set up, the various discs were shown, when that of the triplexicon came out in bold relief, a result which was received with much applause.

A discussion took place as to the relative merits of the various lights, to which Mr. Hughes replied, the result being that his invention appeared to be considered a great success.

The Chairman, in presenting a vote of thanks to the lecturer, expressed himself highly gratified at the result, and said that the disc produced by the triplexicon light was little less effective than that of the oxy-hydrogen. He felt confident that such a magic lantern would find its way readily into schools and among clergymen for educational and religious purposes. He wished Mr. Hughes every success, and trusted that his invention would meet with every encouragement.

F. H. Varley, Esq., Ch. E.C., in seconding the vote of thanks, quite concurred in the remarks of the chairman, because he was somewhat acquainted with the technicalities of lamps, and knew how many failures had arisen in experiments with a view to perfection in combustion of lamps having from one to five wicks. He felt sure that Mr. Hughes must have laboured hard to obtain the result he had, and must compliment him on his invention, feeling sure that he would reap the reward he deserved. The magic lantern had become now a very popular instrument, and hitherto very poor effects had been produced by the existing oil lights; but now certainly the triplexicon light was all that could be desired. He wished Mr. Hughes every success.

After a cordial vote of thanks to the chairman the proceedings terminated, those present being unanimous in their expressions of approval as to the brilliancy of the light. Among the audience were several lantern manufacturers and scientific gentlemen.

FOREIGN SCIENCE.

Amongst the most useful and meritorious inventions of 1877, says *Les Mondes*, there are to be quoted the Alphabets and mechanical calculators of M. Chambon. There are in these little simple and elegant machines all the results of a persevering work sustained by a courage against adversity worthy of the highest eulogium. We have been conscious of the inventor struggling long against first difficulties numberless, and always coming to life. But M. Chambon overcame these obstacles. The calculating alphabet is composed of a little rectangular box, in which is rolled round upon two cylinders forming part of said box a sheet of paper with all the elements of the alphabet; alphabet properly called means words to spell in syllables, dissyllables, and polysyllables; numeration; very extensive multiplication tables, Roman figures from 1 to 1000. On the box are inscribed from the left the twenty-five minuscule letters of the alphabet; in the middle the majuscules; to the right the figures 0 to 10, then from 10 to 100 in tenths, then, in fine, from 100 to 1000 by hundreds; these will serve as comparative terms with the Roman figures printed on the sheet and also as multiplicators. Of the table of Pythagoras, a metallic button fixed at the extremity of each of the cylinders upon which the sheet is rolled as an S, turns them from right to left. The point is that the attention of the child bears entirely on the word, letter, or character which is indicated to it. In a book, on the contrary, the distracted pupil is tormented by the sight of a whole page of words that it does not know how to seize. The rolling of the sheet and the methodical disposition of the characters are such that we see letters and syllables one after the other pass successively with the characters impressed on the box form the ba, be, bi, bo, bu, &c., and the words which we wish to impress on the memory of the young pupil. An account of the multiplier is given which, upon a surface ten times less than that of the multiplication table for the use of children, gives products from 2 to 100 by 2 to 100. A year ago the Society for Encouragement of National Industry presented a most flattering mention to the inventor. A medal of honour, with a prize, offered by the Minister of Public Instruction, achieved the recompense lately of M. Chambon.

The Imperial Academy of Sciences of Vienna has resolved to continue the prizes decreed since 1872 for the discovery of telescopical comets. The prize consists according to the pleasure of the person who receives it, of a gold medal or the monetary value of twenty ducats.

French science has just lost a very distinguished chemist, M. Lamy, professor in the Central School of Arts and Manufactures of Paris, and former Professor in the Faculty of Sciences of Lille. The discovery of a new metal—thallium—was claimed for him, but the better opinion seems to be that this discovery belongs to Mr. Crookes.

An apparatus for projection has been invented by M. Marey. It is composed of a box in which is placed the lamp. This lamp merits a particular mention, because it is the original part of the instrument. It is formed of a rectangular box, about 0·03m. or 0·04m. thick, full of mineral essence. On the middle of the box are placed two large *meches*, independent of each other, and placed so as to present their body to the condenser of the apparatus. These two *meches*, instead of being parallel, converge a little to each other, so that the light thereof is united like a roof. They are besides more related on the side of the condenser than the opposite side. Plates of glass adapted to the two extremities of the envelope of the lamp keep in motion the current of the air, and concur in forming a bright and brilliant flame. At the back is a silvered mirror, which reflects the light on two large *lentelles*, which discharge the office of condenser.

A committee composed of members of the Institute and members of the Scientific Association of France has just been appointed to erect a statue to M. Leverrier, the illustrious astronomer. Subscriptions will be received at the secretariat of the Institute, Quai Conti.

Five or six years ago, on the estate of a proprietor, in Vernon, a thunderbolt fell into an enclosure of gooseberries and cherries, and made a deep hole there, the orifice of which was not quite ten centimetres in diameter. Since then everything has died round about it, and the area has increased every year. Now it is seven metres in diameter, and has reached a cherry tree of twelve years' planting, which dies like the others. What is the cause of this? Science *pour tous* attributes it to the thunderbolt, but how is it that its morbid action has persisted, and that sterility has seized the formations. Has the thunder engendered deleterious chemical compositions in the plants? Has it burned the humus? We do not know this at present.

THE VACUUM BRAKE.

COMPLYING with the recommendation of the Royal Commission on Railway Accidents that a continuous brake of some sort should be under the control of every engine-driver, enabling him to stop a train within 500 yards, the different railway companies are severally fitting their engines and carriages with these appliances, differing in form and even in principle, but tending to the same desirable end. First to adopt the mechanism, and to apply it to an entire plant, was the Metropolitan, which line, from the peculiarity of its traffic, may be said to have needed some such safeguard more than any other railway. Investigations made in America by Mr. Watkin, of the South-Eastern Company, and reported on by him, led to the adoption of Smith's vacuum brake, first on the former and then on the last-named line, a contract having been made for the fitting of the whole of their rolling stock with this invention, which is also in use by the Manchester, Sheffield, and Lincoln Railway. Having tested the merits of various brakes, the Great Northern Company is following the example of the above-mentioned railways in the choice of Smith's vacuum brake, and is applying it as rapidly as possible. Fast trains on the Midland are likewise being run with the same apparatus: and an opinion in favour of its principle has been expressed by the authorities of the Great Western, as also by those of other lines. The recommendations of this brake—whether in its original form, or under the modification by Mr. Hardy, which, by means of a double ejector, affords a separate action upon the engine and carriages—appear to be its freedom from complications and the simplicity of its self-acting character. It has no valves, stop-cocks, or intricacies of any kind, and it will perform with certainty any number of stops in a day; nor is it liable to get out of order, either by constant wear for a long period, or by remaining for a length of time unused. The driver, by means of a vacuum gauge, can always satisfy himself whether or not the hose is coupled up and uninjured, and while the working is readily at his command; the brake can also be applied by guards or passengers, by means of the signal cord, or electric communication. When the brake is absolutely automatic, a second reservoir is attached, and the vacuum is maintained ready to act upon the brakes in case of a train parting. But whether self-acting, in the full sense of the term, or governed by the handle, which admits steam through the neck of the ejector, drawing out air by means of a pipe, and thus causing a vacuum, the collapsing apparatus under every carriage is acted upon by simple atmospheric pressure, and is never-failing. The form in which the vacuum brake still generally known as Smith's will henceforth be constructed will constitute it strictly, as well as nominally, a Hardy's brake, both patents being combined. But the general principle of the two appliances is the same; and the public, who demand a continuous and efficient brake, show little concern in mere engineering points of difference.

ELECTRIC LAMPLIGHTING.

ON Saturday evening, the 13th ult., the first public trial of Mr. St. George Lane Fox's system of lighting street lamps by means of electricity was made with the gas lamps in Pall-mall and its immediate vicinity. For a fortnight or so preparations had been going on for thus putting the invention to the test, for which permission was given by the St. James's Vestry. Many persons have doubtless observed that the lamps have been connected up with aerial wires, which are attached to a light iron framework which surrounds the glass casing of the lamp. This, we need hardly say, is only a temporary arrangement, and devised for the purposes of the present trial. In practice nothing more would be seen than the small piece of boxed-in mechanism just beneath the gas-burner in each lamp, as the electric wires would be laid in the ground, and led up the interior of the lamp-posts. Indeed, some of the lamps in Pall-mall are now connected by underground wires where the distance is great between them. Mr. Fox's system was fully described in the *Times* of December 4 last year, so that we need only now explain it generally, and as applied in the present case. On the top of the gas-pipe is screwed a metallic box containing a small electro-magnetic apparatus. This apparatus is carried in a small framing, which is made hollow, and allows the gas to flow through it to the burner. The gas is turned on or off by means of a valve or gas-cock, having a projecting lever, which is removed either to the right or left by means of a permanent reciprocating magnet, on which are a couple of studs, which engage alternately with the lever of the valve. The movement of this magnet is effected by a change in the polarity of an electro-magnet, consisting of a soft iron core in a coil. According as the current is sent forwards or backwards through the coil, so the polarity of the core is altered. The permanent magnet, responding to the alternations of the current, vibrates to and fro, alternately opening and closing the gas-cock.

The electric current which effects these operations is obtained from a magneto-electric machine and a battery which are placed in a small temporary instrument house at the bottom of Waterloo-place. The current is conveyed by the wires which are seen suspended from lamp to lamp. A current having been sent through which has turned the gas on, it next has to be lighted. This operation is performed by transmitting along the wire a powerful discharge obtained from a condenser (placed also in the little instrument house) raised to a very high electro-motive force by means of a Ruhmkorff coil. By means of a secondary coil of fine wire which surrounds the primary coil of the electro-magnet, a secondary current is produced along the wires which lead from the coil to the top of the burner. At this latter point a small electric spark is produced which ignites the gas. The discharge which passes through the primary wire has the same effect simultaneously on the secondary wire of all the lamps in the circuit. Therefore, the gas having been previously turned on in the manner we have described, the whole of the lamps which are connected up by the wire are lit at one and the same moment. To extinguish the gaslight a reverse current is sent through the primary wire from the magneto-electric machine, and this causes the permanent magnet to make a partial revolution on its axis. In so doing one of its two studs, to which we have referred, engages with the lever of the gas-cock, and, reversing its position, shuts off the gas, and thus extinguishes the light.

The lamps to which this system has been thus experimentally applied are fifty-five in number, and are situated in Pall-mall, part of St. James's-street, Waterloo-place, and part of Regent-street. The experimental lighting was commenced at five o'clock on Saturday, and at first the whole of the lamps in the circuit were lighted by the aid of electricity. They were then extinguished by the same means, and some necessary adjustments of the mechanism in some of the lamps were made. A subsequent attempt to re-light them, however, proved but partially successful, several lamps on the circuit refusing to answer to the electric discharge. Several speculative theories were advanced in order to account for this untoward circumstance. It was suspected that the workmen had deranged the apparatus in some of the intermediary lamps, and it was suggested that the battery power was unequal to the occasion. One fact, however, is certain, and that is that the first and last lamps in the circuits always answered perfectly to the electrical discharges, thereby indicating that the non-ignition of the others was due to some local defect. This is the more probable seeing that one lamp at the south-eastern corner of Pall-mall and Waterloo-place remained permanently lighted when the others were extinguished. Whatever the cause it is to be regretted, although Mr. Fox does not regard it as at all serious, and expressed himself quite satisfied that it would be easily set right. The advancing twilight, however, forbade this on Saturday, as all the lamps had to remain lighted for public service. It is to be hoped that the difficulty will be got over, and that this highly ingenious system will shortly be in working order. It would have been as well, however, if all the arrangements had been perfected and thoroughly tested before a public trial was made. But Mr. Fox may console himself with the reflection that he is not the first by very many who have temporarily failed in their first public essay. So far as can at present be seen, the defects developed on Saturday in no way affect the soundness of Mr. Fox's system.

DIRECT ACTING OR NON-ROTATIVE PUMPING ENGINES AND PUMPS.

By HENRY DAVEY, Assoc. Inst., C.E.

THE following is the substance of a paper recently read at the Institution of Civil Engineers:—

Mr. Davey commenced by discussing some new forms of direct acting pumping engines and pumps, as a question of relative cost and efficiency, illustrating his arguments by practical examples. The direct acting engine had a wider sphere of application in mining operations than elsewhere, and experience had proved it to be the best type for deep mine and heavy pumping. Until lately, the Cornish had been the only direct acting expansive engine. It was a very economical machine under favourable circumstances, but its range of expansive working was limited. Compound rotative engines had been made to do a higher duty than Cornish engines. In the early days of pumping, Hornblower, Trevethick, Woolf, and Sims experimented with compound Cornish engines in Cornwall; but these attempts had failed because the engines were single acting, and the distribution of steam was such as to lead to great thermal loss from the cooling influence of the condenser. From these and other practical defects the engines fell into disuse. To work direct acting engines expansively, certain conditions were necessary. An inert mass must be provided, which, by its inertia at the beginning and momentum towards the end of the stroke, should compensate for the diminishing pressure of the expanding steam employed in overcoming the almost uniform resistance of the pump. In single cylinder engines this involved heavy initial strains, considerable piston speeds, and a large inert mass to render a high degree of expansion possible. These obstacles were removed in the direct double acting compound engine. This part of the subject was graphically illustrated by indicator and velocity diagrams, taken from compound and Cornish engines under various conditions of working, the results being tabulated. The relative cost of compound and of Cornish engines was next compared, and it was shown that the cost of the engine and buildings was less for the compound than for the Cornish engine. The author then described certain improvements in valve gears, and discussed the construction of pumps and pump valves, advocating much heavier lifts than those commonly used. As examples a 200-horse power compound engine, employed underground, in forcing against a column 1100 feet in height, and a 600-horse power compound engine, actuating two 20-inch plungers by spears, against a column 700 feet, were referred to. An improved form of pump work was adopted to render such heavy lifts practicable and safe. Twenty varieties of pump valves were illustrated, and diagrams of the lift of pump valves, and others showing the shocks produced in the opening and closing of valves, were exhibited.

In an addendum the author touched briefly on three questions of special interest in connection with the subject of the paper. These related to the economical use of steam, in regard to the degree of expansion, as to how greater economy might be secured, and as to the condition of maximum efficiency.

ON THE EMBANKMENTS OF THE RIVER THAMES.

By EDWARD BAZALGETTE, Assoc. Inst. C.E.

THE River Thames is the arterial drain for 5264 square miles. Its source in Gloucestershire was 330 feet above the mean level of the sea. It traverses 210 miles, and is tidal to Teddington Lock. In dry weather the discharge is about 470 million gallons daily. Its waters have been prevented from overflowing large tracts of land by embankments formed under various Acts of Parliament. The removal of Old London, Westminster, and Blackfriars Bridges enabled the tide to ebb and flow more freely, by which the navigable channel has been deepened. The width of the river is, however, still very variable. Above Southwark Bridge it is 670 feet wide, and the waterway between the piers of that bridge only 600 feet. At Hungerford Bridge, before the formation of the Victoria Embankment, the width was 1340 feet, whilst opposite Millbank it was only 610 feet, increased to nearly double that width at Battersea. Mud banks have formed along the foreshore, and between Westminster and Blackfriars about 27 acres of mud exposed at low water on the north side.

The first Commissioners for embanking the Thames were appointed in 1367. Acts for constructing embankments and improving the navigation were passed in the reigns of Henry VIII. and of Elizabeth. Sir Christopher Wren proposed an embankment from the Temple to the Tower, after the fire of London in 1666. Sir Frederick Trench and Mr. Martin suggested similar embankments. In 1840 Mr. James Walker laid down a line for a northern embankment for the Corporation of London, to be raised four feet above Trinity high water. His line and levels had since been adopted. Various Parliamentary Commissions and Committees have considered the subject. In 1862, an Act was obtained by the Metropolitan Board of Works for the formation of the Victoria Embankment, from Westminster to Blackfriars Bridge. In 1863, another Act was passed for the construction of the Albert Embankment, from Westminster to Vauxhall Bridge. And, lastly, in 1868, the Act for the Chelsea Embankment, from Chelsea Hospital to Battersea Bridge, was sanctioned. These embankments comprise about 3½ miles of river wall, and had reclaimed fifty-two acres of land.

The length of the Victoria Embankment is about three-quarters of a mile, and the area reclaimed is 37¼ acres. The roadway is 100 feet wide from Westminster to Blackfriars Bridge, and is continued nearly all the way from thence to the Mansion House of a width of 70 feet. The cost of the embankment had been £1,200,000, besides £450,000 paid for the purchase of property. The tides now rose higher than in former years. On the 15th of November, 1875, the tide was 17 feet 1 inch, and in January, 1877, it was 16 feet 6 inches above datum. This had been attributed to the formation of the embankments;* but it had been ascertained that the cause was chiefly due to the removal of old bridges and other obstructions. This embankment is formed with a sewer and a subway for gas and water pipes in the retaining wall. The subway is 7 feet 6 inches in height and 9 feet in width, and the sewer varied from 7 feet 9 inches to 8 feet 3 inches in diameter. The batter of the wall is slightly curved, and the wall is faced with granite, fine axed, up to high water line, and moulded above that level. There are steamboat piers and landings at various points. The Metropolitan District Railway traverses the whole of this embankment, the level of the rails being 17½ feet below the surface of the roadway, which is supported by iron girders. The foundations of the embankment vary in depth with the nature of the ground, but are 32½ feet below Trinity high water. They were formed partly behind whole-timber dams driven into the clay, as previously described by Mr. Ridley (Min. of Proc. Inst. C.E., vol. xxxi., p. 3), and partly behind wrought-iron caissons, the caissons being used in bad ground and near to the bridges, and around the landing piers. The clay was reached at about 28 feet below Ordnance datum, but near Westminster Bridge it was 32 feet deep. The level of the foreshore sloped from 6 feet above to 7 feet below datum. The foundations were carried down to 20 feet below datum; they rest mostly on the clay, and are formed of Portland cement concrete up to 12½ feet below datum, at which level the brickwork commences. The bottom portions of the iron caisson cofferdams were filled with concrete, and left in the ground permanently, and the piles of the wooden cofferdams were cut under water at various levels, in both cases to protect the toe of the wall. The upper portions of the caissons were in half rings, and were capable of being used several times. When bolted together these rings formed an oval 12 feet 6 inches in length by 7 feet wide in the centre. The rings were 7 feet 6 inches deep, and were made of ¾-inch and ½-inch wrought-iron plates. The lowest ring of each caisson was of cast-iron, weighing about 32 cwt., and it had a cutting edge at the bottom. The caissons were bolted together longitudinally, and strips of felt rendered the joint watertight. These dams, like the timber dams, were supported by timber shoring from the land side, and the upper portions of the dams consisted of half caissons only, by which a considerable saving was effected. In each caisson there was a sluice, worked from the top, for admitting or discharging the tidal waters. The caissons were sunk by weighting them, and excavating within them by three methods: 1, by men working inside, the water being kept down by pumping; 2, by men working within, the water being excluded by pneumatic pressure; and, 3, by a telescopic dredger, the water being allowed to rise and fall within the cylinders. By the first plan 6 cubic yards, by the second 5·31 cubic yards, and by the third 10 cubic yards of material were excavated per diem. Again, according to the first system, a cylinder was sunk on an average in eight days and a third, and the labour cost 14s. 6d. per cubic yard. By the second, a cylinder was sunk 20 feet in eleven days and a half, and the labour cost 12s. per cubic yard. By the third, a cylinder was sunk in less time at a cost of 8s. per cubic yard for labour.

The Albert Embankment is about 4300 feet long, and is similar in elevation to the Victoria Embankment. It has, however, neither sewer nor subway behind it. The foundations are carried to a depth of 30 feet below Trinity high water, and the wall is formed behind a whole-tide timber dam partly of single piles closely driven and caulked. Opposite Millbank the river has been widened for a length of 800 feet from 600 feet to 720 feet. Good foundations for this embankment were more easily reached than on the other side. Part of the embankment wall is formed of concrete instead of brickwork, and the whole is faced with granite. The works cost £309,000.

The Chelsea Embankment was commenced in July, 1871, and completed in May, 1874. It extends from Battersea Bridge to Chelsea Hospital, and is upwards of three-quarters of a mile in length. The wall is composed of Portland cement concrete, faced with hammer-dressed granite. It has a sewer from 5 feet 9 inches to 6 feet 9 inches in diameter behind it, conveying the sewage from Hammersmith to the Western Pumping Station. It reduced the width of the river from 850 to 700 feet, and reclaimed 9½ acres of foreshore. The roadway is 70 feet wide, and 5 feet above Trinity high water. The foundations are carried to 10 feet below Ordnance datum, or 4 feet under low-water spring tides, and they are put in behind a half-tide dam. A trench was dredged and concrete blocks were bedded upon the ground at low water up to 3 feet 3 inches below datum. Above this level the concrete was filled in and bonded with the granite facing. The cost of this work, including the low-level sewer and roadway, was £134,000. The introduction of concrete in lieu of brickwork effected a saving of about £21,000. A short length of this embankment, opposite Cadogan Pier, settled in consequence of the removal of some piles, which formed part of the old pier, in front of it. The wall has since been underpinned from the land side, and its toe protected by sheet piling.

[The point indicated by * should be fully developed to the metropolitan world, for it is certainly believed, and not unreasonably, that the embankments have been the great cause of the mischievous high tides.—ED. SCI. REV.]

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SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

President, SIR ANTONIO BRADY.

SESSION 1877—1878.

MEMBERS' MEETING.

On Thursday, 9th May, at 8.15 p.m., Exposition of Railway Inventions.

Executive Council at half-past Seven on same evening.

SPECIAL NOTICE TO MEMBERS.

The Annual General Meeting for the Election of Officers, &c., takes place at 4 p.m. on Thursday, 23rd May next. An Executive Council precedes this meeting.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts. F. W. CAMPIN, Sec.

Proceedings of the Institute.

ON 28th March the Executive Council met, the President, Sir Antonio Brady, being in the Chair. The minutes of the last meeting having been read and passed, and the finance report, by the Secretary, Mr. F. W. Campin, made and accepted, he then stated that he had received copies of Mr. Anderson's Bill for the amendment of the Patent Laws, and explained its details (given in our last issue, page 55.) After some appropriate remarks, Sir Antonio Brady moved, and it was seconded by Mr. Calley,—"That Mr. Anderson's Bill is hereby approved by the Inventors' Institute, and that steps be taken to give every support that the Institute can give to the measure." This was passed unanimously. It was also resolved, on the motion of Dr. McGrigor Croft, seconded by Mr. Blanchett,—"That a petition be sent in favour of the Bill to the House of Commons, and that the President and Secretary be empowered to prepare and sign the same." N.B. This petition has been prepared and signed, and presented by Mr. Anderson.

On 11th April there was no business before the Executive Council calling for a report, and the meeting placed on the list for 28th April did not take place, in consequence of that day falling in the holiday week.

MEMBER'S MEETINGS.

On the 28th March Mr. W. C. Hughes read his paper "On Lighting, by means of New Lamp Arrangements, specially applicable to the Magic Lantern," a full report of which will be found in another column.

On 11th April, it was reported by the Secretary that nothing further was expected to be done on Mr. Anderson's Bill till May, Mr. M. Zingler and Mr. Lancaster made some observations on the details of the Bill, which, though wholly favourably to the same, were understood to put forward the proposition that the Bill would be a sufficient settlement of the patent question for the present time, if the term of provisional protection were prolonged to *one year*, as in the Attorney-General's Bill last year, and its cost reduced to *ten shillings*, and in addition to this *Special Paid Commissioners* were appointed to work the Patent System, with every regard to facilitating investigation into the novelty of patenting inventions, and pointing out to Parliament what amendments in the patent laws are desirable.

Monthly Notices.

Father Pietro Angelo Secchi, one of the most noted and successful of European astronomers, who died in Rome on February 26, was born in 1818, and in 1850 became director of the Observatory of the Roman College. Here he invented a plan of meteorological observations, completed a survey of the Papal States, and conducted a water supply into Rome. He was the author of numerous valuable astronomical works, and was specially distinguished for his discoveries in spectroscopic analysis and in solar and stellar physics.

The discoveries in Central Asia are to be utilised for Roman Catholic missionary purposes. The missionaries have been instructed in the use of scientific instruments. So we may at least hope for some good for science.

For the Fellowship of the Royal Society the Council have selected and recommended (out of fifty-five candidates) for election on June the 6th next Messrs. J. G. Baker, F. M. Balfour, Rev. T. G. Bonney, Prof. J. H. Cotterill, Sir W. Elliot, Canon W. Greenwell, T. Hawksley, C.E., J. Hopkinson, D.Sc., J. Hughlings Jackson, M.D., Lord Lindsay, P.R.A.S., S. Roberts, E. A. Schäfer, H. Sprengel, G. J. Symons, and C. S. Tomes.

The President of the Institution of Civil Engineers, Mr. Bateman) will give a conversazione, to gentlemen only, on Monday, June 3rd, in the galleries of the India Museum at South Kensington.

An Engineering Laboratory at University College is about to be established at a considerable cost by the Council. It is to be under the direction of Mr. Kennedy, the Professor of Engineering.

Inflammability of Flour-dust Clouds.—The Berlin Verein für Gewerbefleiss has awarded a prize to Prof. R. Weber for his investigations into the causes of mill fires. He shows that all sorts of flour in dust-clouds are inflammable, and he confirms the results obtained by Mr. Galloway, that some of the explosions in coal-mines, supposed to be due to fire-damp, have really been caused by clouds of coal-dust.—*Athenæum.*

The Death of Dr. James Booth, the well-known mathematician, is announced by the *Times.*

The Italian Cryptogamic Society founded in 1858 by De Notaris, has just been reconstituted under the presidency of Prof. F. Ardissone, of Milan. It consists of two classes of members: ordinary (*effetivi*) and foreign. The former consist entirely of Italian, the latter of foreign cryptogamic botanists, the foreign members being elected by the vote of the ordinary members. The Society will publish annual volumes of its "atti," and, in addition, one or more fasciculi every year, each containing fifty new or interesting specimens of cryptogams, at a cost of 10 lire (Italian) the fasciculus. The British corresponding members at present are the Rev. M. J. Berkeley, Dr. R. Braithwaite, Dr. M. C. Cooke, Mr. Jas. Stirton, and Mr. John Smith. Cryptogamists who are not members of the Society are invited to contribute descriptions or specimens of new species, for which they will receive in exchange the volume or fasciculus containing their contributions.

Signalling by means of the Telephone.—Dr. Puluj, of Vienna, exhibited at a recent session of the Imperial Academy an ingenious arrangement for signalling by means of the telephone. The vibrating membranes in two connected telephones are replaced by a pair of tuning-forks giving the same number of vibrations per second. A bell is placed close to each fork, and a brass ball is suspended from a thread between the two, but in contact with the fork. If one of the forks be put in vibration by means of a hammer the movement is communicated to the other, which causes a loud ringing on the bell by means of the ball. A response can be sent back in the same manner, and after replacing the vibrating membranes the usual method of communication begins.

The Intellectual abilities of the Japanese race have been evidenced in a striking manner by a quartette of students from that country now studying in Berlin. One of these, Dr. Dirokitao, has lately invented an ingenious optical instrument termed the leucoscope, which measures the variations in the perception of light and colour by the human eye, in accordance with the strictest mathematical laws. Another, who has attained the rank of lieutenant in the Prussian Army, has introduced a remarkable simplification into the mechanism of the Manser rifle, which has succeeded the historical needle gun. Two more, who are prosecuting their chemical studies under Prof. Hofmann, have published for two years past several interesting synthetical researches on the aromatic series.—*Nature.*

The Scientific Review.

MAY, 1878.

THE PARIS EXHIBITION.

On the first day of the present month of May, 1878, with stately ceremonial, in which His Royal Highness the Prince of Wales is to take part, as are also several other Royal Princes and many persons of eminence in Science and in Art, the Paris Universal Exhibition opens.

Since the famous Hyde Park Exhibition of 1857 there has not been one that has come up to its standard, and the one that now opens at Paris appears likely to be no advance on that great industrial display, except in one point, which we shall presently allude to.

Doubtless there are reasons easily recognisable for the inferiority we have alluded to, and in the present case everyone must see that the Eastern war, and the rumours of war now prevailing, must necessarily have the effect of preventing the present Exhibition from fully possessing the universal character it ought to. But we are of opinion that this is not the only cause, indeed not even the chief cause, of deficiency in the present Exhibition; for the changed aspect of the commercial and industrial relations of the countries of Europe and of the United States of America have far more to do with the matter. The Exposition of our industrial status in 1851 showed the world not only our strength but our weakness, and this latter was noted by other nations, who have since then made use of the knowledge thus acquired to place their own industries very much in advance of what they were at that date; consequently all exhibitions since then have become comparative displays in which the competitors are pretty much on a par, and therefore the interest which was excited in this country by the proud position of ascendancy we occupied is well nigh lost. Indeed, there are not wanting those who say that we have been retrograding; for whilst other countries have had the benefit of well organised systems of technical education practically at work, we have done little else than talk about the desirability of this kind of education.

Some time ago we presented to our readers the views of Sir William Thomson on the results of the late American International Exhibition at Philadelphia, in which he alluded to the evident advantage accruing to the industries of the United States by the freedom with which inventive genius was brought to bear upon their arts and manufactures, and similar views, with the addition of remarks on the superiority of the technical training of Americans, set forth by the *International Review*, a New York journal of the highest class, have been more recently noticed by us.

Such being the state of matters, it will be readily understood that the Exposition now opened at Paris can excite in the industrial circles of this country only a languid interest, and must prove of little benefit to the progress of our arts and manufactures, unless some new features can be brought out. Happily there seems a good chance that at the present Exhibition fresh points of interest will be presented to us, both in regard to invention and technical education. The first, it would seem, is to be met by some action being taken in regard to the Patent Laws, and the second is to be provided for by the British Royal Commission, under the presidency of His Royal Highness the Prince of Wales, who have announced that they are desirous that artisans should be delegated to attend the Exhibition, and examine and report upon the special technicalities of the various industries displayed thereat. It is true the Commission has adopted a course which would at first sight appear as if the whole matter was simply the result of a movement on the part of the Society of Arts, because the intentions of the Commission have been made known in the form of a letter to the Council of that Society, in which the Prince of Wales says that the "Royal Commission will contribute a sum of one hundred guineas, out of the vote which has been placed at their disposal for the British section; and as a further proof of the interest which, in common with my colleagues, I take in the promotion of these visits, I propose to request certain members of the Royal Commission to form themselves into a Committee for the purpose of co-operating with the Council of the Society of Arts."

We happen to know that whatever may have been the action taken by the Council of the Society (and its efficient Secretary, Mr. P. Le Neve Foster, would doubtless take action herein), the matter was brought under the notice of the Commission by the working men of this country, and the resort to that Council is the natural outcome of the resolution of His Royal Highness and the Commission over which he presides, it being well known that at former exhibitions that Council has promoted the visits of artisans with the objects and intentions referred to; and in the present case they have, it is stated, voted one hundred guineas for the same purpose, and appointed a Committee to cooperate with the Committee nominated by His Royal Highness Under these circumstances we trust that the most intelligent members of the artisan class will be selected without regard to any extraneous considerations, and if we were asked to name some who for technical knowledge, and the great interest they have taken in the cause of technical education and promotion of invention, we should refer to Mr. Thomas Mottershead, who has several times contributed to our columns, Mr. Henry Broadhurst, Mr. Paterson, and Mr. Savage, all of whom have cooperated with the Inventors' Institute in its movements on Technical Education and the Amendment of the Patent Laws. Mr. Mottershead has had many years' experience as a practical weaver, and is thoroughly competent to deal with the department of textile manufactures; and all the above-named are experienced and reliable men, who are well known amongst the working classes, and may fairly be considered as representative men—this latter point to our mind being of great importance, for we consider that if the Paris Exhibition can be made a matter of supreme interest to the working classes on the one hand and to inventors on the other, it will form the beginning of a new era, not only for Technical Education and Industrial Progress, but also for Exhibitions, and will render the name of the Prince of Wales only second to that of his Illustrious Father as Promoter of their Success and Disseminator of their Benefits.

Proceedings of Societies.

ROYAL SOCIETY.

March 14th.—Sir J. Hooker, President, in the chair.—The following papers were read: "On Prof. Haughton's Estimate of Geological Time," by Mr. G. H. Darwin, "Some Experiments on Conductive Properties of Ice made in Discovery Bay, 1875-6," by Staff-Surgeon R. W. Coppinger, and "On the Function of the Sides of the Vessel in maintaining the State of Supersaturation," by Mr. C. Tomlinson.

March 21st.—Sir J. Hooker, President, in the chair.—The following papers were read: "Contact Theory of Voltaic Action, Parts I. II.," "On a Metallic Cell and on Electrolytes of great Resistance," "On the Viscosity of Dielectrics, No. I.," by Messrs. W. E. Ayrton and J. Perry.—and "Recent Exments on Fog Signals," by Dr. Tyndall.

March 28th.—Sir J. Hooker, President, in the chair.—The following papers were read: "On Putrescent Organic Matter in Potable Water," by Mr. G. Bischof; "On the Modifications of the Simple and Compound Eyes of Insects," by Mr. B. F. Lowne; "Measurement of Electrical Constants, No. II., On the Specific Inductive Capacities of Certain Dielectrics," by Mr. J. E. H. Gordon; "On the Placentation of the Apes, with a Comparison of the Structure of their Placenta with that of the Human Female," by Prof. Turner; and "On the Thermo-Electric Properties of Liquids," by Mr. G. Gore.

ASIATIC SOCIETY.

March 18th.—Sir E. Colebrooke, President, in the chair.—Mr. F. D. Mocatta and the Rev. J. Shirt were elected Resident Members, and Mr. G. H. Damant a Non-Resident Member.—Mr. Thomas called attention to the well-known Phrygian inscription of Dogenlu, and announced his discovery of various dots on it which had escaped the notice of previous inquirers, demonstrating, as these did, a much higher antiquity for it than had been previously supposed. Papers were then read, communicated by Capt. J. C. F. S. Forbes and Mr. H. L. St. Barbe respectively; the first, "On the Tibeto-Burman Languages;" the second, "On the Transliteration of Burmese."

ENTOMOLOGICAL SOCIETY.

March 6th.—H. W. Bates, Esq., President, in the chair.—Mr. J. Woodgate was elected a Member.—Mr. F. Moore (at the request of Sir W. H. Gregory, late Governor of Ceylon) exhibited a large series of drawings, executed by native artists, of the transformations of the Lepidoptera of that island. These drawings were made under the direction of Dr. Thwaites, and represented for the first time the life history of many species.—Mr. M'Lachlan exhibited some entomological parts of the great Russian work, "Fedtschenko's Travels in Turkestan." Mr. H. Goss exhibited a small collection of fossil insects obtained by Mr. Gardner from the Bournemouth Leaf Beds (Middle Eocene). The collection comprised numerous elytra of Coleoptera and wings of Neuroptera, &c. Mr. J. M. Weale read some "Notes on South African Insects." These referred to variation in *Pieris Severina* and *Pieris Mesentina*; to the secretion of formic acid in *Termes triniverius*, and the probable localisation of the same in a cephalic process, and also to the larvæ of some Hesperidæ in relation to the subject of protective resemblance.—Mr. E. Saunders read a paper, entitled "Remarks on the Hairs of some of our British Hymenoptera." From a microscopical examination the author found that the presence of branched or plumose hairs is characteristic of the Anthophila, whilst the hairs of the Fossores, of Heterogyna, and the Diploptera are all simple or in some cases twisted. Mr. A. G. Butler communicated a paper "On the Natural Affinities of the Lepidopterous Family Ægeriidæ." From an examination of structural characters, Mr. Butler considered that these insects presented no resemblance to the Sphingidæ, with which they had hitherto been allied, but were more related to the Pyrales and the Gelechiidæ. The President, in favour of this view, remarked that the whole of the Ægeriidæ had been made to depart from their congeners in appearance, through the action of mimicry. The Secretary read a paper, by Mr. A. H. Swinton, "On the Biology of Insecta as determined by the Emotions." The paper dealt chiefly with cases of simple muscular contractions and secretions. Mr. P. Cameron communicated a paper "On some new Genera and Species of Tenthredinidæ."

STATISTICAL SOCIETY.

March 16th. — After the election of a numerous list of candidates for fellowship, including the Earl Beauchamp, Messrs. A. J. Balfour, E. R. King-Harman, and A. H. Brown, a Japanese student, and others, a paper was read by Mr. C. Walford, "On the Famines of the World, Past and Present."

March 15th.—E. Chadwick, Esq., in the chair.—A paper "On the Colonisation of Hill Districts in India," was read before the Indian section by Lieut.-General M'Murdo.

SOCIETY OF ARTS.

March 19th.—Sir G. Elliot, Bart., M.P., in the chair.—A paper "On Egpyt: its Commercial Changes and Aspects," was read before the African section, by Mr. B. F. Cobb.

March 20th.—F. J. Bramwell, Esq., in the chair.—Five candidates were proposed for election. A paper "On Emery Corundum Wheels for Grinding and Surfacing Metals and other Materials, was read by Mr. A. H. Bateman.

March 27.—Lieut.-Col. Sir E. Du Cane in the chair.—Six candidates were proposed for election.—A paper, "On State Aid to Music at Home and Abroad," was read by Mr. A. S. Cole.

March 28th.—Dr. R. J. Mann in the chair.—A paper "On Electric Lighting" was read before the Chemical Section, by Dr. P. Higgs.

March 29th.—A. Cassels, Esq., in the chair.—A paper "On the Depreciation of the Value of Silver, with especial Reference to the Exchange between England and India, and Suggestions for a Remedy," was read before the Indian Section, by Col. J. T. Smith.

April 3rd.—W. Hawes, in the chair.—Eight candidates were proposed for election as Members. A paper "On Our Wealth in Relation to Imports and Exports, and the Causes of Decline in the Latter," was read by Mr. E. Seyd.

INSTITUTION OF CIVIL ENGINEERS.

March 26th.—Mr. Bateman, President, in the chair.—The paper read was "On Direct Acting or Non-Rotative Pumping Engines and Pumps," by Mr. H. Davey.

April 2nd.—Mr. Bateman, President, in the chair.—Messrs. R. R. Greene, T. Hack, A. W. Hemans, C. Mines, P. O'Meara, and C. J. Wood were elected members; and Messrs. T. Armstrong, J. M'L. Blair, J. J. Bodmer, C. A. Grieve, W. Hayward, M. Kingsley, S. R. Linging, E. M. Richards, J. Salter, C. W. Scriven, G. H. Stayton, M. W. Thompson, and A. Ventris, Associates. The paper read was "On the Huelva Pier of the Rio Tinto Railway," by Mr. T. Gibson.

CHEMICAL SOCIETY.

March 21st.—Dr. Gladstone, President, in the chair.—The following papere were read:—"On Aromatic Nitrosamines," by Dr. O. N. Witt. The author gives an account of his study of some complicated reactions of diphenyl-nitrosamine. He has found that ordinary ethylic nitrite contains nitric acid, and has, therefore, used mixtures of pure amylic nitrite and nitric acid for acting on diphenylamine, and has obtained mono-nitro-diphenyl-nitrosamine in light yellow plates, melting at 133·5° C., and two bodies which, on the removal of their nitrose groups, yielded di-nitro-diphenylamine and an isomer. The final product of the action of strong nitric acid is hexa-nitro-diphenylamine.—"On a new process for the Volumetric Estimation of Cyanides," by Mr. J. B. Hannay. The cyanide is dissolved in water, and the solution rendered alkaline by ammonia. A standard solution of mercuric chloride is run in with constant stirring until the liquid is distinctly opalescent. The end reaction is sharply marked and very delicate. The presence of silver does not interfere, so that the process can be used for estimating the cyanides present in a plating bath.—"On Certain Bismuth Compounds, Part VII.," by Mr. M. M. P. Muir. The author has compared the behaviour of bismuthous and phosphorous chlorides in certain reactions. The latter substance acts as a reducing agent in some cases, in which the former does not exert any such action. The author has also studied two oxalates of bismuth, the production of so-called bismuthates, and some reactions of bismuthous iodide. Mr. Williams exhibited a fine sample, 24 ounces, of natural salicylic acid, and about one gallon of pure methylic alcohol.

METEOROLOGICAL SOCIETY.

March 20th.—Mr. C. Greaves, President, in the chair.—Mr. B. C. Smith was elected as Fellow.—The discussion on Dr. Tripe's paper, "On the Winter Climate of some English Seaside Health Resorts," was resumed and concluded, after which the following papers were read: "Notes on a Waterspout," by Capt. W. Watson,—"Notes on the Occurrence of Globular Lightning and of Waterspouts in Co. Donegal, Ireland," by Mr. M. Fitzgerald,—and "Observations of Rainfall at Sea," by Mr. W. T. Black.

MATHEMATICAL SOCIETY.

March 14th.—Lord Rayleigh, President, in the chair.—Mr. A. Martin was proposed for election. The Secretary communicated a paper, by Prof. C. J. Maxwell, "On the Electrical Capacity of a long Narrow Cylinder, and of a Disc of Sensible Thickness," Prof. Cayley, Mr. J. W. L. Glaisher, Mr. S. Roberts, and the Chairman made impromptu communications.

PHOTOGRAPHIC SOCIETY.

March 12th.—J. Glaisher, President, in the chair.—Papers were read "On the Fading of Carbon Prints, and the suppression of Bichromates in Pigment Printing," by Dr. Van Monckhoven, and "On Non-covering Perpendiculars in Architectual Photographs," by Mr. E. Cocking. Dr. Monckhoven asserts that bichromates in carbon prints are not all eliminated, and that they are still subject to the action of light, so that the fugitive pigment used also suffers, and therefore is liable to fade. He suggests, as a fixing agent, bisulphate of soda, and for coloured pigment some of the oxides of iron.

GEOLOGICAL SOCIETY.

March 20th.—H. C. Sorby, Esq., President, in the chair.—Mr. J. W. Head was elected a Fellow.—The following communications were read: "On the Chronological Value of the Triassic Strata of the South-Western Counties," by Mr. W. A. E. Ussher,—"Note on an *Os articulare*, presumably that of *Iguanodon Mantelli*," by Mr. J. W. Hulke,—"Description of a new Fish from the Lower Chalk of Dover," by Mr. E. T. Newton,—"Further Remarks on Adherent Carboniferous Productidæ," by Mr. R. Etheridge, jun.,—and "On the Submarine Forest at the Alt Mouth," by Mr. T. M. Reade.

GEOGRAPHICAL SOCIETY.

March 25th.—Sir R. Alcock, President, in the chair.—The following gentlemen were elected Fellows: Capt. T. L. Phipson-Wybrants, Lieut. H. P. Routh, Messrs. G. W. Campbell, J. Campbell, A. Hicks, H. Page.—The papers read were "On Lake Nyassa, and his Journey from its Northern End, *via* Ugogo, to Zanzibar," by Mr. H. B. Cotterill—and "On overcoming (Geographical) Obstacles to African Trade by Economical Animal and Mechanical Expedients," by Mr. J. L. Haddan.

HISTORICAL SOCIETY.

March 14th.—J. Heywood, Esq., in the chair.—The Chairman announced that, in consequence of the increased attendance at the Society's meetings, the Council had applied for and obtained more extensive accommodation in Dr. Williams's Library Buildings, Grafton-street East. There the Society would meet in and after June next. Four members were admitted by ballot. Papers were read by Mr. S. Robjohns, "On Canada, Past and Present," and by Mr. G. L. Gomme, "On the Historical Manuscript Commission, and Anglo-Saxon History."

ANTHROPOLOGICAL INSTITUTE.

March 12th. — Mr. J. Evans, D.C.L., President, in the chair.—Prof. A. G. Bell read a paper "On the Natural Language of the Deaf and Dumb." The author stated that in most cases dumbness is merely a consequence of deafness, and does not arise from any deficiency in the vocal organs, but merely from the inability to acquire articulate language from want of means of imitating it. This can be supplied by teaching. The dogma "without speech no reason" is not well founded. Deaf-mute children think in pictures. Thence they form a language of signs which, as contractions of it become understood, developes into a conventional language, but its extent is very limited. No deaf-mute has been found who had formed the idea of a Supreme Being. About the commencement of the present century, the Abbé de l'Epée opened an institution for the education of deaf-mutes. The tendency of education was to render the language more and more conventional by means of contractions. Of this Prof. Bell gave many interesting examples. The result of systematic education has been to enable the deaf-mutes to form a community among themselves, using a real language, representing abstract ideas as well as mere objects. Not only so, but the language has idioms of its own. For example, the objective case comes first—thus, "the boots made the bootmaker." This is a difficulty, and perhaps a mistake, in the education; it affords, however, a useful subject for anthropological inquiry into the analogy with the development of spoken language. In illustration, Prof. Bell delivered the Lord's Prayer in the sign language. The North American Indians have a sign language the same in character but less developed than that of the deaf-mutes. The language of the deaf-mutes is beginning to split into dialects.

CAMBRIDGE PHILOLOGICAL SOCIETY.

March 21st.—Prof. Kennedy, President, in the chair.—A paper by Mr. Paley was read, "On the Sources from which the Helena of Euripides was derived."

QUEKETT MICROSCOPICAL.

March 22nd.—Dr. J. Matthews, V.P., in the chair.—Two new members were elected. —A new form of air-pump, designed by Mr. E. Gardner, for use in the preparation of the microscope, was exhibited and described by the Secretary.—A paper on a new Micrometer," by Mr. G. J. Birch, was read by Mr. Curties. The micrometer scale was of considerable size, ruled upon card, and placed at the end of a rod extending from the eyepiece at right angles to the axis of the instrument, and being reflected upon a piece of glass placed immediately above the eye lens, at an angle of 45°, was clearly seen coincident with the field of view. It was equally available for use with the telescope. —A paper by Mr. S. Green, "On a Method of Preparing and Preserving Insects for the Microscope without Pressure," was read by the Secretary.

BRITISH ARCHÆOLOGICAL SOCIETY.

March 20th.—Mr. Syer Cuming in the chair.—Flint implements of various kinds, sling stones, and arrow-heads, from Luton and its neighbourhood, were described by Mr. W. Smith.—Mr. Prigg described a bronze weight with the Clare arms, found at Bury St. Edmunds.—Mr. Luxmore exhibited Spanish antiquities in bronze, among which was one with the cockle-shells of St. James of Compostella; the Rev. S. M. Mayhew a mould for casting pilgrims' signs; and Mr. C. Brent another representing the dead Christ and the gloves of St. Thomas à Becket,, while the reverse side of the stone was utilised for casting other signs, among which was a royal head, presumed to be that of St. Ethelbert. It was found at Canterbury, and was most probably used for the manufacture of signs for sale to the pilgrims to the shrine of St. Thomas.—Mr. Grover exhibited two bronze celts from Worthing, found five feet below the surface, with fragments of still older pottery. Mr. G. Wright reported the discovery of a Roman villa at Eastbourne, at Splash Point, on forming a new roadway. There are fragments of pillars and of pavement, but the excavation is of limited extent.—The first paper was by Mr. H. Prigg, who detailed the result of excavations he had made within a singular earthwork on West Stow Heath, Suffolk. A circular enclosure, about 340 feet in diameter, contains traces of occupation of very early date, and the fragments of pottery produced were pronounced to be Celtic in character. Flint implements were also found. The enclosure consists of a raised circular bank for about half the extent, and the remainder in an ordinary ditch.—A discussion ensued, and the analogy of the enclosure with other unclassed circles was pointed out by various speakers.—The second paper was by Mr. E. P. S. Brock, who described the recently discovered cavern at Eltham Park. This had been explored purposely when it was illuminated by the owner of the property. It is 37 feet broad and 53 feet long, and reached by a shaft 142 feet deep, lined with brickwork of no great age. The chamber, however, is of remote antiquity, resembling as it does so many of the chalk caverns of Essex, and the "bottle pits" of Chiselhurst, and other parts of Kent.—A long discussion followed, and Mr. Brent mentioned a remarkable excavation at Bickley. He has traced it for more than a mile in extent, and it is said to extend for three miles.

NUMISMATIC SOCIETY.

March 21st.—J. Evans, Esq., President, in the chair.—Major A. B. Creeke sent for exhibition a rubbing of a coin of Harold I., reading LEOFWINE ON BV, probably struck at Buckingham.—Mr. A. E. Copp exhibited pieces of five guineas with the elephant, two guineas, and one guinea of Charles the Second; five guineas, two guineas, and one guinea of William the Third, 1701, and five guineas of William the Third, 1700.—Mr. Vaux read a letter from the Hon. J. Gibbs, Deputy Governor of Bombay, on unpublished Zodiacal Rupees, struck in the reign of Jehangir, A.D. 1605-1627; also a paper communicated to him by Mr. E. Thomas on the Phrygian inscriptions of Doganlu, near the old town of Cotiæum in Phrygia, one of which has been recognised as indicating the site of the tomb of Midas and repeatedly published, first by Leake and Walpole, and more recently by Mr. Hamilton and Baron Texier, *vide* Rawlinson's "Herodotus" (vol. i., p. 666). Mr. Thomas was of opinion that the language of the inscription was essentially Aryan in a transition stage, which in his judgment must have prevailed before the separation of the Greek and Latin stocks. He further believed that he had discovered in the inscription at the foot of the tomb certain dates, pointing to the year B.C. 920 and 848. A discussion followed, in which the President, Mr. B. V. Head, Mr. P. Gardner, and Mr. C. F. Keary took part, and agreed in thinking that no evidence whatever had been adduced in support of Mr. Thomas's hypotheses either as to the existence of an Aryan alphabet before the separation of the Greek and Latin stocks, or as to the interpretation as numerals of certain letters occurring apparently as portions of words in one of the inscriptions.

ZOOLOGICAL SOCIETY.

March 19th.—A. Grote, Esq., V.P., in the chair.—The Secretary exhibited the type specimen of *Dicrurus Marginatus* of Blyth, and pointed out its identity with *Muscipipra vetula* (Fam. Tyrannideæ).—Mr. J. W. Clark made remarks on some stuffed specimens of the Sea Lion (*Otaria ursina*) of the Prybylov Islands.—Communications and letters were read: from the Marquis of Tweeddale, the sixth of his contributions to the ornithology of the Philippines, the present memoir giving an account of the collections made by Mr. A. H. Everett in the Island of Leyte, —by Mr. P. L. Sclater, on the collection of birds made during the voyage of H.M.S. Challenger, in the Sandwich Islands,—from Mr. W. A. Forbes, on a small collection of birds from the Samoan Islands and the Island of Rotumah, Central Pacific,—from Mr. F. Nicholson, on the birds collected by Mr. E. C. Buxton at Darra Salam, on the coast of Zanzibar,—by Messrs. F. Du Cane Godman and O. Salvin, on new species of Central American butterflies of the family Erycinidæ,—by Prof. A. H. Garrod, on the visceral anatomy of *Lycaon pictus* and *Nyctereutes procyonides*,—and from Mr. A. Anderson, on a new Indian Prinia, obtained in the Bagesur Valley, North-Western Himalayas, which he proposed to name *Prinia poliocephala*.

INSTITUTION OF NAVAL ARCHITECTS.

April 11th. — Annual Meeting. — Lord Hampton in the chair.—The Secretary read the report of the Council for the year, which stated that the finances of the Institution were in a satisfactory condition, and there was a balance of £575 in hand. Some routine business was then transacted. The Chairman in his address remarked that the past year had been one of the most eventful and satisfactory years since the first establishment of the Institution. He congratulated the meeting upon the success which followed the last autumn meeting, which was held in Glasgow, and upon the great accession to the number of members to their Institution, and considered that they were now more than ever an institution representing the profession of shipbuilding, and those who were desirous of forwarding and promoting the success and welfare of this great maritime power. The noble chairman then proceeded to review the subjects of the various papers set down for discussion; and, in regard to the question of torpedoes in warfare, said he did not think torpedoes had had a sufficient trial in the late war between Russia and Turkey to justify any decided opinion in respect to their value in war. No doubt public opinion pointed to the fact that they were very formidable and dreadful engines of war, and he thought they were so horrible an engine of war when successfully used that nothing would please him better than to hear that they were perfectly impracticable. (Hear, hear.) In referring to the loss of her Majesty's ship Eurydice, his lordship said it would be almost a breach of the feelings they all entertained as an institution that no reference was made at that meeting to so dreadful an event. He did not refer to the matter with a view of blaming, if blame were due, but in accordance with their feelings they would express their deep regret and hearty sympathy with those who had lost their friends in the dreadful accident. (Hear, hear.) The first paper for the consideration of the meeting was read by Mr. B. Martell, Chief Surveyor of Lloyd's, "On Steel for Shipbuilding." He said that it had long been felt that the production of a material like the present mild steel, possessing its properties of ductility and superior strength, and being perfectly uniform and homogeneous in quality, would be a most desirable substitute for the ordinary iron used in the construction of our mercantile vessels. Till the last year or two much doubt existed as to whether these conditions could be ensured to the required extent, and at a cost compared with iron. The time had, however, come when it was said by others besides manufacturers that steel can be used with as much confidence as iron. The paper dealt fully with the whole question in all its details. The remaining papers down for consideration were as follows: "On the Comparative Efficiency of Single and Twin Screw Propellers in Deep-draught Ships," by Mr. W. H. White; "On the Elementary Relation between Pitch, Slip, and Propulsive Efficiency," by Mr. W. Froude; and "On the Theory of Deep-sea or Oscillating Waves," by Dr. Woolley.—At the evening sitting a paper was read by Mr. W. Denny "On Lightened Scantlings." Mr. J. Wigham Richardson, in a paper "On the Load-line of Steamers," stated that from a sailor's point of view, common sense showed that there was a just medium in loading, and that, though a very light ship may be like a bladder on the water, any captain would rather have three inches side per foot of hold than only an inch and a half. This would hardly be gainsaid; and in the same way as regarded empty grain spaces, common sense would show that by a proper arrangement of holds, each hold may be filled entirely with grain, and at the same time a good side may be secured by leaving empty or air spaces at the ends of the ship. Therefore, as far as mere navigation was concerned, candid minds would generally allow that steamers would be much safer to navigate if a better side was given than was the practice in some ports. For his own part, he should not hesitate to say that in many cases the side allowed was far too little, and that it was of paramount importance to endeavour to check the deep loading which often prevailed. The contention that increased cargo lessened the strain was ingenious, but it would not hold water. A paper was also read by Mr. H. H. West, "On the Application of the Decimal System of Measurement in Practical Shipbuilding."

April 13th.—Lord Hampton in the chair. Mr. W. H. White, Assistant-Constructor of the Navy and Instructor in Naval Architecture, read a paper entitled "A Note on the Geometry of Metacentric Diagrams." Dr. Woolley, Mr. Scott Russell, Mr. Johns, and Mr. E. J. Reed, M.P., spoke upon points in the paper, the last congratulating the Institute upon receiving the benefit of Mr. White's labours in this study. For himself he could not help thinking that the principles enunciated in this paper, if they had been known, might have had a very striking and practical application. They might, indeed, have had a very serious application to the case of the Eurydice, as from what he could remember of her he thought she had a depression of the metacentric curve, and he thought inquiry should be made into her construction in this particular. The subject of the loss of the Eurydice should not be dismissed by saying that the calamity was caused by "a gust of wind" or because her "ports were open," for he held that there were questions of science to be cleared up which the circumstances surrounding such a calamity would elucidate, and if he could obtain the designs of the Eurydice he should be inclined to make the calculations as to the metacentric curve in that vessel. Mr. C. Böhm then read a paper "On Crude Petroleum (Greek fire) Equipments for Purposes of Naval Warfare." Referring to Lord Dunsany's declaration, at the United Service Institution, against the use of petroleum in naval warfare and his advice that "no quarter" should be given to those who used it, Mr. Böhm urged that, in the face of the fact that petroleum was already a recognised agent of warfare, it would be wiser to seek for adequate antidotes against the effect of the petroleum weapon than to rely upon a savage mode of warfare which nailed on its flag "no quarter." We could not shut our eyes and fail to take into consideration the acts of such States as Great Britain, France, the United States of America, and Russia, which four highly-respectable and powerful States had already used hydrocarbon compounds in warfare during the last twenty-five years, and it was not on record that any Government had protested against it. He argued that petroleum could be thrown with accuracy upon any desired spot in any requisite quantity within fifteen seconds to a distance of 300 feet, and that one gallon of crude petroleum, if judiciously discharged over a surface of 100 square feet and then ignited, would render that area uninhabitable for human beings during ten minutes. The petroleum apparatus could be placed on any ironclad or craft, and be of any desirable size, as it was intended only to serve as an additional equipment, in order that the ship or boat carrying it should be able to retain its original armament and crew, whatever it might be. He described in detail the petroleum apparatus and the method of ignition on a hostile ship, and contended that the ten or fifteen minutes gained by the attacking petroleum torpedo boat would be sufficient to capture or destroy an ironclad, because during the ten or fifteen minutes the crude petroleum was burning even the largest ironclad would be rendered *hors de combat*. The naval engagements in the late Russo-Turkish war had fully disclosed that large ironclads must expect to be attacked by small steam launches, and also that the discharge of a petroleum stream on to the ship about to be attacked would give a better opportunity to apply the spar torpedo, inasmuch as the fire and smoke from the petroleum would drive the men from the guns, and the torpedo boat could approach within striking distance without fear of being fired upon and explode a torpedo under the ironclad. Experiments had been tried in Russia, and, although too late to put them in practice during the late war, it was concluded by a commission that liquid fire could be applied with advantage against an enemy's ships. An ironclad of the largest size and provided with the best armament would be in a critical position if attacked by some light steam launches carrying spar torpedoes and crude petroleum equipments. The weak points of large ironclads seemed at last to have received due recognition by naval men, and authorities like Lord J. Hay, Lord C. Beresford, Captain Price, and others had begun to advocate that torpedo launches should be attached to the ironclads of the British Navy. Such launches having to fight at close quarters would have constant opportunities of using the petroleum weapon, which could be most successfully employed by those who were well acquainted with its qualities and uses. Admiral Selwyn expressed the hope that attention would be given to the subject in this country, so that we might be prepared in case the material was used against us. A paper by Mr. Colin Archer, of Laurvig, Norway, was read "On the Wave Principle applied to the Longitudinal Disposition of Immersed Volume;" one by Mr. R. Clark, of the Imperial Engineering College, Tokio, Japan, "On an Easy and Effective Method of Ascertaining the Rudder Power of Ships." and one "On Depth as a Factor in the Computation of Yacht Tonnage." The President announced that the Council of the Institute had decided to ask the First Lord to become a Vice-President of the Institute, and Mr. T. Brassey, M.P., to become an Associate Member of the Council.

PHYSICAL SOCIETY.

March 16th.—Prof. W. G. Adams, President, in the chair.—A special general meeting was held, for the election, as an *ex-officio* Honorary Member of the Society, of the President of the Physical Society of Paris. The following candidates were then elected Members: Dr. J. Hopkinson, Miss E. Prance, Messrs. S. Bergheim, W. M. Hicks, and T. Willis. The Secretary read a paper, by Mr. W. J. Millar, "On the Transmission of Vocal and other Sounds by Wires." The author was led, mainly by a consideration of the manner in which sounds are conducted through walls and partitions, to make an extensive series of experiments on this subject, from which he concludes that conversation can be carried on at considerable distances by simply employing stretched wires provided with suitable vibrating discs. In one experiment two copper wires were attached to points on a telegraph wire 150 yards apart, and breathing, singing, &c., were distinctly audible: by stretched wires extending through a house and provided with mouth and ear pieces in the several rooms, conversation could be carried on without difficulty. The materials employed for terminals were very varied; and the vibrating disc, whether metal, wood, or india-rubber, &c., was generally formed as a drum-head, the wire being fastened at its centre. The volume of sound appears to be greater with a heavy wire, but in all cases it requires to be stretched. The President referred to the experiments of Wheatstone on the conduction of sounds by vibrating bodies, especially long wooden rods. Some years ago M. Cornu, in conjunction with M. Mercadier, made experiments which showed that vibrations can be transmitted along a copper wire and rendered visible at the distant end on a rotating blackened drum. The free end of the wire was attached to a copper foil fixed at its base, and provided with a point which left a clear trace on the drum when the distant end was attached to, say a vibrating tuning-fork. Mr. W. H. Preece described some experiments made in September of last year, by Mr. A. W. Heaviside and Mr. Nixon, at Newcastle-on-Tyne on this subject. Mr. G. W. von Tunzelmann read a paper "On the Production of Thermo-electric Currents in Wires subjected to Mechanical Strain." Prof. Adams exhibited a simple arrangement for projecting Lissajous's figures on to the screen, which has been made by his assistant, Mr. Furze.

THE HOOGHLY FLOATING BRIDGE.

This bridge which connects Calcutta on the left with Howrah on the right bank of the Hooghly, at a short distance north of the East Indian Railway terminus, formed the subject of a paper read by Mr. Bradford Leslie, M. Inst. C.E., on 5th March, at the Institution of Civil Engineers; Mr. Bateman, President, in the Chair. Various projects, the paper stated, had been from time to time proposed; but ultimately the preference was given to a floating bridge, as it could be more cheaply and expeditiously constructed than a fixed bridge. The design was prepared in 1868, when it was intended to be carried out by a joint stock company; but after much delay, in 1872 it was undertaken through the agency of the Local Government of Bengal. The work was commenced in January, 1873, and the bridge was opened for traffic in October, 1874.

The present structure was the first, and, up to this date, the only one of its kind affording headway for river navigation. It divided the port into two sections. The lower part was occupied by sea-going ships and steamers, and the upper part by inland craft and a few coasting vessels. As, however, the graving docks were above bridge, it was necessary that an opening should be provided for the passage of shipping. The extreme rise and fall of the tide during floods was 20 feet, and at certain seasons there was a tidal wave 6 feet in height. The maximum velocity of the steam was 6 miles an hour. The depth of the river at the site of the bridge was variable, the greatest depth at low water being 6 fathoms.

The bridge was 1,530 feet long between the abutments, and the roadway was 48 feet wide, with footpaths each 7 feet in width on both sides, so that the total width of the platform was 62 feet. There were four main longitudinal wrought-iron girders, at intervals of 16 feet in the width of the roadway, raised by timber trusses, resting upon pontoons, to a convenient height above the water for accommodating the boat navigation. The platform of the bridge was level for a distance of 384 feet on each side of the centre, at a height of 27 feet above the water. Thence it fell by inclines of 1 in 40 to a distance of 584 feet on each side of the centre line, where there was a length of 20 feet of level platform, 22 feet above the water. Between these points and the abutments were the adjusting ways, the shore ends of which were 32 feet above low water. The approach on the adjusting ways was by a descent of 1 in 16 at extreme low water, and by a corresponding ascent at extreme high water; but at ordinary times it was either level, or only slightly inclined. The platforms of the adjusting ways were supported on the lower flanges of three bow-string girders, the roadway being divided into two by the centre girder. The footpaths were carried on cantilevers riveted to the outer girders. The bow-string girders weighed 66 tons each. They were 160 feet long between the end pins on which they were hinged, and had the usual trough-shaped upper and lower members. The shore ends of the bow-string girders were suspended on links, which was preferable to carrying them on rollers, even for fixed bridges, as being less liable to get out of adjustment, and tending always to restore the girder to its normal position as its mean temperature. The outer floating ends were hinged to pivot bearings, in order to admit of a slight drift up and down stream.

The floating portion of the bridge was carried on twenty-eight pontoons, coupled together in pairs to secure stability. With the exception of the two pairs in the centre, which supported the movable sections of the bridge, each pair carried 100 feet in length of the platform. Each pair was coupled together, at a maximum distance of 48 feet from centre to centre, by four timber cills, bolted to the decks of the pontoons at intervals of 16 feet. These cills constituted the bottom members of the four main longitudinal trusses, the top members being the wrought-iron girders carrying the roadway. With the exception of the upper girders, the whole of these trusses were of teak. The coupled pontoons were further connected by strong horizontal diagonal bracing of bar iron. The timber cills and the bracing being only 4 feet above the water, the space between the coupled pontoons was not available for navigation, and floating fenders or booms were provided to divert boats from these openings. Ordinarily the main girders overhung the pontoons 21 feet, their ends being supported by the inclined struts of the trusses, leaving a width for navigation of 42 feet, partially obstructed by the raking struts. For the convenience of the country craft, there were two rectangular openings of 60 feet clear span between the fourth and the fifth pairs of pontoons, reckoning from each abutment. The roadway over these openings was carried on eight girders, each 2¾ feet deep, and weighing 8 tons. They rested on saddles secured to the top of the cross-bearing girders, which were suspended to the ends of the ordinary main truss-girders. All the pontoons were 160 feet long, by 10 feet beam, with holds varying from 8 to 11 feet in depth, according to the dead weight to be carried. Each pontoon, excepting those of the movable sections, was accurately anchored by permanent moorings, laid exactly in line with the centre of the pontoon, the distance between the up and the down stream anchors being 900 feet. The strain on the chain cables varied from 5 to 25 tons; their great length afforded the necessary "spring," to allow for the rise and fall of the tide, but a few links were taken in during the dry season, and slacked out again during the flood season.

The 200 feet opening for the passage of ships was one of the most difficult problems in designing the bridge. Owing to the strength and irregular set of the stream and eddies, ships could only be moved at or near slack tide; and it was a rule that all vessels of more than 200 tons must be moved by steam against the tide. The bridge was generally opened twice a week at high water, but occasionally at low water. The opening was effected by removing the two centre sections of the bridge bodily. These sections were connected with the fixed portions of the bridge by drawbridges, which on being run back left a clearance of 20 feet on each side of the platform of the movable sections. By means of steel warps, laid to buoys moored for the purpose, these sections were warped up stream far enough to clear the rest of the bridge. They were then disconnected and sheared over, one on each side, leaving a fair way clear of all obstructions. The bridge was closed by reversing these proceedings. The ordinary time taken in opening the bridge was fifteen minutes, and in closing it twenty minutes.

There was a daily traffic of about 6,000 tons of heavy goods, which were conveyed in bullock carts, besides foot and carriage passengers. The ironwork of the pontoons weighed 1,650 tons, that of the girders 875. The whole of this, as well as the mooring chains, was sent from England, and was erected and riveted up in Calcutta. The teak timber, which weighed 1,500 tons, was procured from Burmah.

The different parts of the structure was minutely described. An account was also given of the operations connected with the laying of the forty-eight permanent moorings, with the fitting of the truss work, with the hoisting into position of the sixteen 60-feet girders, and with the erection and launching of the 160-feet bow-string girders. The particulars were likewise recrded of an accident that delayed the completion of the work about three months. This arose from a deeply-laden ship fouling two vessels, which parted from their moorings, and both were sent up stream on the top of the "bore" at the rate of 5 knots an hour. One vessel went through the centre opening, but the other struck the bridge, causing three pontoons to be sunk, and superstructure to be completely wrecked.

REECE'S PATENT ICE MAKING MACHINES.

THE very important improvements alluded to in the annexed report of Dr. B. H. Paul, whose favourable opinion is always entitled to earnest consideration, have recently been made in the construction and arrangement of Reece's patent ice machine and refrigerating apparatus, and have resulted in constituting it one of the most valuable discoveries of recent years, since it claims to secure the manufacture of pure transparent ice in large quantities, by which the expense and loss by storing are avoided, and also cooling of wort or water in breweries, distilleries, chemical works, &c. By reducing the temperature of the water employed for cooling purposes, it will double the power of the refrigerators already in use; enabling the brewer greatly to increase his production and to brew with equally good results at any season of the year. The machine is, it appears, now in use at Messrs. Charrington, Head, & Co.'s, Sir Henry Meux & Co.'s, and other breweries, and a similar machine is in course of construction for the eminent firm of Messrs. Combe & Co. The price at which the cold is produced is singularly low—so much so, that it is cheaper to use the water a second time, after cooling it by passing it through the machine, than to pump a fresh supply from any great depth, and an unskilled labourer can learn to work the machine in a month.

Where steam power already exists it may be availed of, and the expense of the apparatus thus reduced in cost. Steam is used to evaporate the ammonia instead of fire; there is therefore no danger of explosion from hot plates, as in an ordinary steam boiler, when the water is allowed to get low by inattention or otherwise. Every part of the machine is carefully tested with high pressure before leaving the works.

When not required for cooling water, worts, or other fluids, the apparatus may be used for making perfectly clear, hard, and transparent ice, of greater density and purer quality than foreign or so-called Wenham Lake ice, and thus a further large source of profit is opened to the brewer. Or the apparatus may be adapted to the cooling of air for use in the fermenting rooms or stores.

In this apparatus the cold is produced without the use of any motive power by the alternate self-compression of ammonia gas into a liquid, and its expansion into a gaseous form. The gas is driven off from its solution in water by the heat of an ordinary steam boiler, and the requisite compression of the gas is very simply obtained by means of its own accumulation.

The simplicity of the apparatus, the absence of motive power, and the excessively small cost at which the cold is produced, render this machine incomparably superior to any other. The apparatus may be used in the hottest climates, as a high surrounding temperature does not in any degree reduce the quantity of ice made. (One has recently been erected and is in full operation at Kingston, in the Island of Jamaica.) The ice produced cannot possibly be tainted with the ammonia, as has been suggested by some rival manufacturers, because the ice boxes are entirely separate and disconnected from the cold producing apparatus, and are even, in some cases, placed in a separate building.

It is important to notice that the cooling power of these machines is not, as in the case of other processes, diminished when low temperatures are required. The result in cooling a given quantity of liquid, say from 53° to 33°, being the same both as regards efficiency and cost as from 93° to 73°. In the production of ice this fact gives Reece's machines an immense superiority over all others.

The advantage of these machines to skating rink proprietors cannot be overrated, owing to its simplicity of working, and the low cost at which it produces ice. The cost of an apparatus capable of keeping 10,000 square feet, or about a quarter of an acre, of ice frozen is £2,685, exclusive of the cost of the rink floor. The company state they are ready to give estimates for larger machines when required.

The Report of B. H. Paul, Esq., Ph.D., consulting and analytical chemist, 1, Victoria-street, Westminster, 21st February, 1876, is as follows:—To the Directors of Reece's Patent Ice Company, Limited: — Gentlemen, — In accordance with your desire, I have examined the Reece's ice-making machine now in operation at the premises, Upper Ground-street, Blackfriars, and I am of opinion that very great success has attended the improvements which have been carried out in the construction of this machine since the time when it was the subject of investigation by a committee of the Society of Arts, and a series of experiments were made under my superintendence in order to ascertain the advantages Reece's method possessed as compared with others.

The general result of the experiments then made was highly satisfactory, so far as the principle of Reece's method was concerned, and the cooling effect produced by the consumption of 1lb. of coal was equivalent to the melting of 9¾lbs. of ice, a result higher than, I believe, has been realised with any other ice-making machine.

Unfortunately, however, the machine then placed at my disposal could not be relied upon for continuous working, and on account of this defect the committee appointed by the Society of Arts to report upon Reece's method of ice making was of opinion that the machine as then constructed could not be recommended for adoption, though at the same time it was considered that with suitable modifications it might be usefully employed for refrigerating operations.

The defect here referred to was entirely due to faulty construction, the inadequate strength of the machine, and the want of suitable adaptation of the several parts. From what I saw, however, on the occasion of my recent examination of your improved machine at Messrs. Phillip's premises, I am of opinion that this defect has now been most thoroughly overcome, and that the very efficient constructive improvements which have been carried out in that machine supply all that was wanting to ensure the realisation of the great advantages which appertain to the use of ammonia as a refrigerating agent according to Reece's method.

The machine which is now in operation worked most satisfactorily in all respects. There seemed to be no difficulty whatever in regulating its working. The amount of labour it required was excessively small; in fact, when the machine is once in operation it consists in little more than stoking a small boiler; and the cooling effects produced were very large.

I find, by experiments made during the working, that this small machine, actuated by a boiler only 4 ft. 6 in. diameter, and 12 ft. long, produced a cooling effect per hour equal to reducing 6,000 gallons of liquor through 6° Fahr. thermometer, or 360,000 heat units per hour, and this reduction was effected when the liquid had already been cooled down to a temperature of about, say, 16° Fahr. At a higher temperature, of course, the reduction through the same number of degrees would be much easier.

The coal consumed per hour was 84 lbs., which gives 4,284 heat units extracted for each pound of coal, and is equal to the cooling of 1,800 gallons per hour, through 20° Fahr., a cooling effect equal to the melting of 1·126 tons of ice, or at the rate of 27 tons of ice in the 24 hours. It follows from this that to cool 1,800 gallons of water through 20° the total cost would be, the coals consumed, which are 84lbs., and the labour of two stokers. The loss of ammonia must be quite inconsiderable, inasmuch as the slightest odour of it could not be detected, and were there any loss it must have made itself felt immediately on account of its great pungency.—I have, &c.,

Benj. H. Paul.

TELEPHONE NOTES.

It is now well-known that if the wire of a telephone be extended parallel to telegraph wires, and supported on the same posts, the clicking of the telegraph instruments will be distinctly heard in the telephone, so that messages passing can be read. This opens a new war utilisation of the telephone, as it will be necessary simply to carry its wire near an enemy's telegraph line to read his dispatches, without tapping his wires.

Another new use of the telephone is in the Norwegian herring fisheries. The fishing season takes place when the herrings come into the shoals to deposit their eggs; but it often happens that the fish accomplish their purpose and go back into deep water before all the fishermen can be warned. Some 120 miles of submarine cable have been laid and telephones connected with it, so that all the fishermen on the coast can be immediately notified.

The telephone is a very simple contrivance, and it would seem that nothing could be more direct than the transmission of the voice to the ear of a listener; yet no less than eight transformations take place. The muscular effort of the speaker is transformed (1) into air vibrations; (2) into metallic vibrations; (3) into magnetic waves; (4) into electric induction; (5) into magnetic induction; (6) into metallic vibrations; (7) into air vibrations; (8) into vibrations of the auditory apparatus of the hearer.

Mercury Telephone.—A French inventor, M. Bréguet, has recently completed a so-called mercury telephone, which is quite a variation on the systems already in use. It is composed of two instruments for transmission and reception, connected by means of wires. Each of these consists of a glass vessel, containing acidulated water and mercury into which is inserted a capiliary tube filled with mercury. One wire connects the mercury in the tubes, and the other that in the vessels. When a person speaks before the transmitter, the vibrations of the air are communicated to the mercury, and cause variations in the electromotive force, which are transmitted to the receiver, and there give rise to vibrations of the air appreciable by the ear. A later simplification of the apparatus consists in using a tube with alternate drops of mercury and acidulated water, forming thus a series of electro-capillary elements.—*Nature.*

Application of the Telephone in Mine Ventilation.—In a lecture delivered at the Society of Arts, by Mr. T. Wills, F.C.S., on "Explosions in Coal Mines," he states, in reference to the subject of ventilation,—I would here call attention to an anemometer devised by Messrs. Arthur Le Neve Foster and H. Hall, in which the telephone has received one of its earliest applications. An anemometer of the ordinary kind used for determining the rate of the ventillating current is so arranged that, at every tenth revolution, a small pin on the axle strikes forcibly against a piece of steel watch-spring. This watch-spring is placed in front of an ordinary telephone, having the iron plate removed, the steel spring occupying, in fact, the place of the ordinary metallic plate. The telephone is connected by wires carried to any required distance with a second complete telephone, and on listening at this instrument every twang of the spring can be distinctly heard; by counting the number of these sounds in a given time, the number of revolutions of the anemometer, and consequently the rate of the air current, can be calculated. In this manner it is easy to ascertain at any point above ground the actual state of the ventilation. This ingenious form of instrument is quite successful in use, and is being employed already in some colleries, its extreme simplicity, coupled with the small amount of apparatus required, rendering it easy of application.

BRISTOL MINING SCHOOL.

Recently Mr. M. Geoffrey Morgans, mining engineer, delivered at the Bristol Mining School a lecture on "Coal Cleansing," the chair being occupied by Mr. Handel Cossham, who remarked that, as they had last session the opportunity of listening to a lecture from Mr. M. G. Johnson on "Coal Washing," as practised in this country, it gave him pleasure to announce that Mr. Morgans would now be able to lay before them information as to the methods which were in successful operation on the Continent, where the subject had received great attention.

The Lecturer first remarked that owing to having made arrangements for the accommodation of other gentlemen whose names were down for lectures, whereby his own now came off two months earlier than expected, he had been unable to complete the prosecution of experiments in two branches of his subject—viz. (1), cleansing by means of centrifugal force, and (2) by means of atmospheric air as a medium for separation, and consequently his subject would be more or less limited to cleansing by means of liquid media. He proposed to deal first with the principles affecting the separation of different minerals by combined flotation and gravitation, and next to describe, with the aid of the numerous drawings and photographs exhibited, some of the most modern plant and machinery for carrying out those principles, directing particular attention to some practical details of construction upon which depended in a great measure the successful operation of various Continental coal-washing establishments, which are greatly superior to anything at work in this country. Samples of coal, coke, and refuse products were exhibited, as well as specimens of the raw material treated in the various cases. These were the more interesting on account of being accompanied by particulars as to analyses, yields, and working costs. After illustrating the influence of form upon the descent of equivalent weights of the same description of material, the lecturer dwelt upon the importance of sizing coal, and described the best machinery for the purpose, special reference being made to "trommel," in which the various sizes of coal were discharged with the least possible travel and breakage. Of the various cases referred to, one related to an establishment where a quantity of 550 tons of coal is treated per ten-hour shift, in which the ash admixture was reduced from 18 to 3 per cent. at a working cost of 1·4d. per ton of mineral treated. Particulars of the cost of this plant were also given. The lecturer gave a very practical description of machines specially constructed for washing coal dust and slimes, which, until of late, have been discarded. In one case, accumulated slimes from earlier washing operations containing 25 per cent. of ash are being successfully cleansed, so as to yield a useful product containing only from 4 to 5 per cent. of ash. A very good coke made from this product was exhibited. Great strides have been made in the successful use of the same water over and ever again in coal washing. This is often important where, from the danger of river pollution, it is desirable to prevent the discharge of water holding mineral particles in suspension. In some cases referred to the escape of effluent water is entirely avoided, and the washed coal is so thoroughly drained of water that the quantity necessary to be added to compensate for loss in this direction (which is the only waste of water incurred) is surprisingly small. Time prevented the lecturer from dealing with the subject of freeing water from minerals in suspension without the aid of settling tanks. The lecture was concluded by reference to the subject of crushing coal and its effect upon the quality of coke as seen in various samples exhibited.

A vote of thanks to Mr. Morgans was proposed by Mr. Cossham for his able and instructive lecture. Mr. Cossham expressed a hope that the information afforded would be published, jointly with some of the other lectures of the course, for the use of those interested in the successful working of collieries.

PATENT POTASH SOAP.

WE have received samples of this soap, which claims that by a solution of it the dirt is attracted and separated from the fibre of the clothes without injuring the texture, instead of being rubbed into the material by the usual process of washing. With this soap, very little rubbing and no brushing is needed; hence the clothes are not injured and worn, and labour is saved. No soda, washing powder, or bleaching powder is required, all of which are very injurious and destructive to clothing, and to the hands of persons using them. The special advantages of this soap are best secured by using cold or lukewarm water; boiling water tends to fix the dirt in the body of the material. For woollens, flannels, &c., this cold water soap is invaluable, as it thoroughly cleanses without the slightest injury. The samples verify the above statements.

The patentees and sole manufacturers are Mackey, Sellers, and Co., 1 and 2, Bouverie-street, Fleet-street, London, E.C.

A DANGEROUS COSMETIC.

MR. CHARLES H. PIESSE, F.C.S., the well-known analytical chemist, makes the following communication in the last number of the *Analyst*: — "I recently had submitted to me for analysis a small quantity of a white substance, in the condition of a magma, and I was informed in reference to it that it was used by an American lady as a face cosmetic. The lady, unable to purchase the preparation in London, desired to have some manufactured especially. The result of my examination showed that the substance consisted wholly of *calomel*, the wetness of the magma being due simply to water. It is needless to add that on my representations the persons to whom the manufacture had been entrusted declined to go any further in the matter, while the existence of such a cosmetic in the American market is another instance of the 'cuteness of the Yankee, regardless of consequences."

SIR GEORGE GILBERT SCOTT, R.A.

SIR GEORGE GILBERT SCOTT, R.A., died suddenly at four o'clock on the morning of March 27 of heart disease. Although he had been suffering from varicose veins recently, nothing was observed within the past few days in regard to his general state of health to create alarm in the minds of his family. By his death the ranks of English architects lose one of their most representative men and most honourable workers. Throughout his long career Sir Gilbert Scott has laboured constantly with the aim of ennobling the profession of which he was at the time of his demise the acknowledged head, and he has left behind him a splendid series of grandly-designed and soundly-executed works to bear witness to the loftiness of the spirit which governed him in the carrying out of his engagements. A grandson of the Rev. Thomas Scott, the learned author of the "Commentary on the Bible," and the son of a clergyman, he may be imagined to have inherited something of that bias towards the study of church architecture which, at any rate, early showed itself, and induced his father to place him with an architect with the view of giving a systematic direction to his studies. Whence he derived his strong love for the Gothic style does not appear in the brief memorials of his life at present available for reference; but wherever it was derived from it exhibited itself, as already strongly developed, in 1844, when he was only 30 years of age, in the first work which brought him into prominent notice—his "Martyrs' Memorial at Oxford." In the following year the rebuilding of the Church of St. Nicholas, at Hamburg, which has been destroyed in the great fire at that city, was entrusted to him in preference to all competitors, English and foreign. In modern times few more important ecclesiastical works have been undertaken by any architect—the estimated cost of the building having been £150,000. In 1855 he entered again into competition with the architects of Europe, and carried off the first prize offered for a design for a new Hotel and Senate House at Hamburg. It was, however, as the head of the school of Gothic revival that his highest honours were won. In that school he had laboured at the time of his death for fully 50 years with a thoroughness of devotion rarely equalled in any branch of art. In 1855 he was elected an A.R.A., and in 1860 an R.A. Her Majesty conferred on him the honour of knighthood in 1872. Besides his extensive labours in the restoration of the Cathedrals of Ely, Lichfield, Hereford, Ripon, Gloucester, Chester, St. Davids, St. Asaph, Bangor, Salisbury, and St. Albans, he has executed a great number of secular works, including the magnificent Infirmary at Leeds, and he was, besides, the author of several books on the subjects in which he was most deeply interested—"A Plea for the Faithful Restoration of our Ancient Churches," "Remarks on Secular and Domestic Architecture," "Gleanings from Westminster Abbey," and "Conservation of Ancient Architectual Monuments: a Paper."

NOTES ON THE LITERATURE OF THE MONTH.

WE regret (says the *Athenæum*) to announce the death of Rizk Allah Hassoun Effendi, a native of Aleppo, and a well-known Arabic scholar. Mr. Hassoun was the author of a metrical version, in Arabic, of the Book of Job and several other works, amongst which one, "The History of Islam," caused him to fall under the serious displeasure of the Turkish Government, and resulted in his taking up his residence in this country, where he recently became a naturalised English subject. He had, perhaps, a larger acquaintance with Arabic poetical literature than any one living. His death is a great loss to Oriental scholarship.

A collection of biographical anecdotes and letters of, or relating to, the late King of Italy has been made by Isaia Ghiron, and will shortly be published by Signor Hoepli, of Milan, under the title of "Ricordi Biografici di Vittorio Emanuele." A biography of the same monarch, with portrait and facsimile of handwriting, is also about to be published by Herr Hartleben, of Vienna. The author is Herr Edward Rüffer, the historical and military writer.

Among the important French works announced for publication are an entirely new work on the "Histoire de Montesquieu, sa Vie et sa Mœurs," by M. L. Vian. A Preface and much new matter will be added to this biography by M. Laboulaye, whose recent edition of Montesquieu's works proved his thorough acquaintance with the great Frenchman's writings.

A well-known rhyme is to be found expressed in an early version in a curious MS. which was exhibited at the meeting of the Cambridge Antiquarian Society, on the 18th of March. It was described by Mr. J. W. Clark as a Psalter, "written for one John Harpur," about 1450:—

"Who that wole be holy, helful, and ryche,
Go betyme to hys bed and ryse erlyche."

RECENT AMERICAN AND FOREIGN PATENTS.

MR. WM. S. DANGLER, of Ottawa, Ohio, has patented a gate hinge, which is applicable to farm gates that are allowed endwise movement as well as a swinging movement. The improvement consists in a reversible bracket of quadrant shape, which is rigidly secured to the gate-post, in combination with a horizontally vibrating guide block bearing an anti-friction roller, on which the gate is suspended and moveable.

Mr. Shreeve Hartshorne, of Bordentown, N.J., has invented an improved potato digger having two sifter ploughs, concaved to turn the soil inwardly, and set one in advance of the other, together with a large central double-concave sifter plough in the rear. The operation is as follows:—The foremost shares are drawn through the earth at a sufficient depth to pass under the hills of potatoes; they loosen and partly elevate the earth, and the rear share elevates it still further. As the earth passes over the share it drops between the sifting rods and is separated from the potatoes.

A fertilizer distributor, having a shaking shoe under the hopper, operated by a scalloped wheel attached to the land wheel, is the invention of Mr. Wm. M. Boon, of Perry, Ga. It is designed for distributing guano and other fine fertilizers, and may be adjusted to distribute faster or slower, as may be required. The machine is somewhat of a wheelbarrow shape, and is operated by hand.

A draft equalizer, or three horse evener, has been invented by Mr. Adolph J. F. Ehrich, of Kellogg, Minn., the object of which is to balance the side draft when three horses are attached to a reaper, plough, roller, &c. This is accomplished by a combination of cross bars and braces with a guide and double pulley, the draft being transmitted from the whiffle-tree and double tree by chains which run through the pulleys.

Mr. Charles Daniel, of Virginia, Mo., has devised a reversible plough, having two ploughshares, one left-handed and the other right-honded, attached at the ends of an arm on a shaft which is journalled to the frame. By means of a lever and locking pin either plough may be brought and kept in position for use, or both may be carried horizontally when it is desired to move the plough from one field to another.

A machine for testing the quality of rolling stock, &c., such as rails, wheels, axles, journals, brasses, springs, and other parts, is the invention of a Hungarian, Szent-Gyorgyi Elek, of Buda-Pesth, Austro-Hungary. The object is to provide a machine for testing at any place the materials, subjected to the same mechanical wear as when in use, and not under the fixed conditions of the ordinary testing apparatus. The machine is called by the inventor a "rotary railway-rail." It has endless rails placed on supporting disks of a revolving axle, upon which the wheels, with their axles, boxes, and other appurtenances, are weighted down as desired. In this manner the inventor claims a means of ascertaining whether materials are furnished according to contract, of deciding between different forms of construction, of testing lubricators, of observing the causes of heating of bearings, and of determining the manner of avoiding the latter.

GLOVE CLEANER.—Castille soap, white, 3 troy ounces; Javelle water, 2 fluid ounces; water, 3 fluid ounces; water of ammonia, 1 drachm. Dissolve the soap by the aid of heat in the water, and when nearly cold add the Javelle water and the water of ammonia. The preparation should form a paste, to be rubbed on the soiled part of the glove with a piece of flannel.

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ESTABLISHED 1st MAY, 1862.

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